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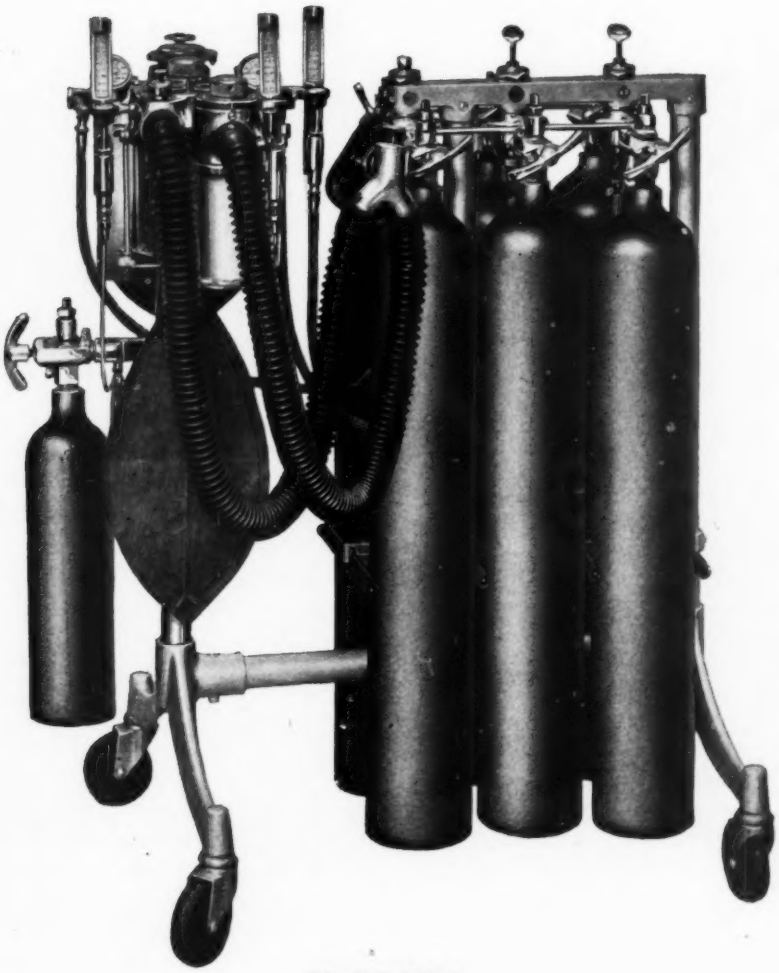

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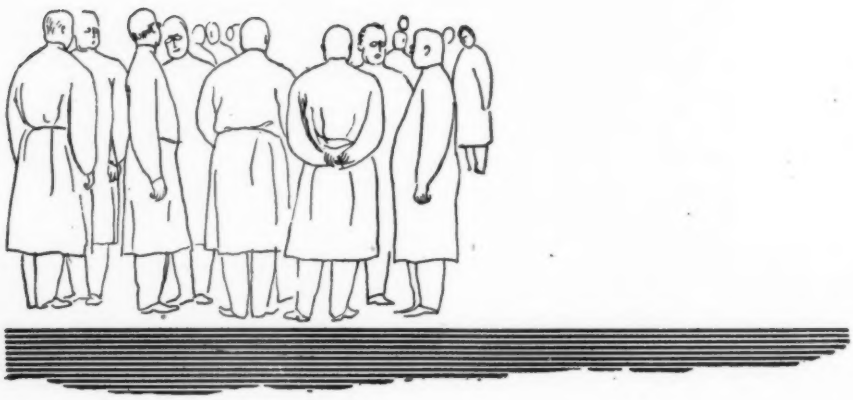

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The Journal of the American Association of Nurse Anesthetists

VOLUME XV FEBRUARY, 1947 NUMBER ONE

CYCLOPROPANE ANESTHESIA IN INFANT SURGERY

Betty E. Lank, M.A.A.N.A.*

Boston

This paper is a report of over 300 cases in which cyclopropane anesthesia was used in the surgery of newborn infants. The field of anesthesia and surgery in infancy is one which has progressed rapidly in recent years. It is now obvious that a great number of congenital abnormalities in the early part of life are amenable to operative relief.

When I left the adult hospital and made up my mind to do children's anesthesia exclusively, some people in the adult hospital said, " Why do you leave us and go to a children's hospital? They are unable to offer nearly as much in the line of major work as we are." On the contrary, I have seen more major surgery and done more major anesthesia than was offered by any adult hospital in which I have worked.

Some of the more interesting and complicated types of operations are: primary anastomosis for atresia of the esophagus, pneumonectomy or lobectomy for cystic disease of the lung, relief of a trachea compressed by a vascular ring, correction of diaphragmatic hernia, repair of omphalocele, alleviation of intestinal obstruction,[1] and plastic reconstruction of anorectal malformation.[2]

After using various forms of anesthesia in the past for the above mentioned types of cases, we have come to feel that cyclopropane offers certain definite advantages:

1. In a child who is debilitated from a severe nutritional impairment, cyclopropane is less exhausting to the patient than is ether anesthesia.

2. For operations which require an open chest, respirations are quieter, which is a great help to the surgeon.

3. The tendency to perspiration is

Read at the Annual Convention of the American Association of Nurse Anesthetists, Philadelphia, Oct. 1, 1946.

*Chief Nurse Anesthetist, Children's Hospital, Boston.

1. Swenson, O., and Ladd, W. E.: Surgical emergencies of the alimentary tract of the newborn. New England J. Med. **233**:660-663, Nov. 29, 1945.

2. Ladd, W. E., and Gross, R. E.: Congenital malformation of anus and rectum: Report of 167 cases. Am. J. Surg. **23**:167, 1934.

reduced, hence the fluid loss is far less for the infant.

4. It is possible to supply a very high percentage of oxygen in the anesthetic mixture so that one can operate more easily upon babies who are cyanotic from such conditions as severe diaphragmatic hernia.

5. The induction stage is cut to half of that required when ether anesthesia is used, especially in the babies who require surgery, sometimes in the first few hours of life. At this age the lungs of the infant are incompletely expanded, and if ether is used, it may take as long as 20 minutes for induction.

6. Recovery from cyclopropane is very rapid, and fewer complications occur than when ether anesthesia is used.

Premedications

The premedication for these young patients can be very simple. Atropine, 1/1,000 gr. (0.065 mg.), is given hypodermically three quarters of an hour before operation. Babies up to age 6 months and sometimes 1 year usually do not tolerate morphine well when it is given in conjunction with a general anesthetic.

When morphine is used, respirations become slow, shallow and jerky and may sometimes stop three or four times during an operation. This, as you all know, is hazardous for the patient, nerve-racking for the team, and most annoying to the anesthetist. When morphine is given in conjunction with cyclopropane anesthesia, arrhythmia occurs, respirations are slow, and the patient becomes cyanotic. Whoever is writing the preoperative orders must be warned of the dangers of morphine for babies. Furthermore, postoperatively, these babies cannot be left alone for several hours because of periods of apnea requiring constant watching and care.

Esophageal Atresia with Tracheoesophageal Fistula

Ladd [3] has divided this anomaly into four types, but more than 90 per cent of them are type 3, this type having two blind esophageal ends and a tracheal fistula communicating with the lower end.

At one time we felt that atropine was contraindicated for operations on babies with these various anomalies, since the subjects are bothered considerably by thick, stringy mucus, and we felt that atropine had the tendency to make the mucus thicker and to aggravate the respirations. Several cases were tried without atropine, and it was found that stimulation on the vagus nerve in the operative field produced bradycardia, which was alarming. Hence the use of atropine was resumed.

The operation for primary anastomosis of the esophageal ends lasts from 2½ to 3½ hours—a long surgical procedure for even an adult to withstand. When open drop ether, nitrous oxide and oxygen, avertin and local were used, our mortality rate on the table was high. However, since using cyclopropane anesthesia, our mortality on the table has been exceedingly low.

It is most important that the anesthetist be in a position at all times to watch the operative site for two reasons. First, the baby is extensively covered with sterile drapes, and it is very diffi-

3. Ladd, W. E.: Surgical treatment of esophageal atresia and tracheoesophageal fistulas. New England J. Med. **230**: 625-637, May 25, 1944.

cult to see the face adequately. Second, respirations in these babies vary from 32 to 100, and when respirations are that rapid, it is absolutely useless and impossible to watch the excursion of the breathing bag. Also, retraction on the extremely thin pleura is great, and because of this, the baby tires and respirations are slowed. When this occurs, the surgeon is asked to remove retractors, thereby giving the baby a rest. This is sometimes done a half dozen times or more. If this thin pleura is punctured by retractors, as sometimes will happen, apnea occurs. Resuscitation is carried out by bag compression with oxygen. If the anesthetist is not in a position to watch the operative site at all times, apnea and slow respirations may occur and go on longer than is necessary. Operative reconstruction of the esophagus can be performed either trans- or extrapleurally. As you all can imagine, the transpleural approach is truly a grave risk to take in the newborn with an operation lasting 2½ to 3½ hours, but some surgeons feel that the exposure is superior. This may be true, but I feel the risk outweighs the other. However, this has been done successfully.

Pneumonectomy or Lobectomy for Cystic Disease of the Lung

These operations certainly are very drastic measures to be taken in the newborn, but it is surprising how well they can be tolerated.[4] The youngest patient to have pneumonectomy was only 8 days old, the operation lasting 1 hour and 10 minutes. Of course, this type of lung surgery varies greatly from that in the older child or adult who may present many problems, such as pleural adhesions, pulmonary infection, and tracheal secretions. Fortunately, in contrast, babies are not apt to have these complicating factors.

As soon as possible, after the conclusion of operation, the baby is turned so that the remaining lung is uppermost, hence has the best chance to function properly.

Anomalies of Great Vessels, Such as Vascular Ring

Some human subjects possess abnormalities of the aortic arch in such a way that the structure is divided or double. This makes a ring of great arteries which constrict the esophagus and trachea. Babies with these particular anomalies have usually had numerous hospital admissions with repeated respiratory infection and pneumonia. Until 1½ years ago these babies usually died, and the cause of death was found at autopsy. The first successful operation for relief of this condition was performed at the Children's Hospital a little more than a year ago.[5, 6] These babies are always a poor risk for both anesthesia and open chest surgery. They are thin, pale, sometimes cyanotic and retracting with each respiration. During the first part of these operations before the surgeon is able to relieve the tracheal obstruction, it is best to avoid the use of pure oxygen in the anesthetic mixture. Instead, it is preferable to use helium 75 per cent and oxygen 25 per cent with cyclopropane anesthesia until obstruction is relieved. We feel it

4. Gross, R. E.: Successful pneumonectomy in a three-week-old baby. Ann. Surg. **123**:229, 1946.

5. Gross, R. E.: Surgical relief for tracheal obstruction from a vascular ring. New England J. Med. **233**:586-590, Nov. 15, 1945.

6. Neuhauser, E. B. D.: Roentgen diagnosis of double aortic arch and other anomalies of the great vessel. Am. J. Roentgenol. **56**:1, July, 1946.

would be extremely difficult to intubate, as it would be hazardous to push a tube through the narrowed trachea. Furthermore, postoperative edema of the trachea would almost certainly occur and perhaps would be fatal.

Diaphragmatic Hernia

Not too many years ago, it was generally felt that any baby found to have a diaphragmatic hernia had a far better chance for life if the operation were deferred until he or she was older. The doctors at the Children's Hospital have done an excellent job in convincing the pediatricians and obstetricians that patients have more than 90 per cent chance of survival if this anomaly is recognized and relieved in the first few days of life.[1] These babies are usually in a high concentration oxygen tent prior to operation for two reasons. First, they are frequently cyanotic and have respiratory distress; second, deflation of the intestines makes it easier to replace them in the small abdominal cavity. The chest approach is sometimes used, but the abdominal approach is more desirable.

Repair of Omphalocele

These babies are sometimes brought to surgery within the first few hours of life, and because of this fact there is apt to be incomplete expansion of the lungs.[1] Hence, it is always difficult to establish anesthesia. Good relaxation is necessary as a great amount of intestines has to be placed in the small abdominal cavity. Cyclopropane anesthesia is given to these patients, and generally ether is added to the mixture for best relaxation.

Intestinal Obstruction

Newborns with intestinal obstruction usually come to operation from 2 to 15 days after birth.[1] Because of vomiting, loss of fluid, loss of weight, abdominal distention, and high temperature, they are poor risks for operation. When open drop ether was used, these babies would invariably stop breathing many times, but since using cyclopropane anesthesia this is a rare occurrence.

During operation care must be taken to retain body heat as much as possible. Arms and legs are wrapped in sheet wadding, and small glass hot water bottles are placed in the axillae and around the body to maintain the body temperature. When ether anesthesia was given to these particular babies, their postoperative course was indeed very rocky for some time. Atelectasis, pneumonia, and much postoperative vomiting occurred—all grave complications. Cyclopropane has cut down these complications almost to a minimum, making it much easier for all concerned and especially the baby. In the extremely poor risks babies with intestinal obstruction, where we do not dare even to use cyclopropane anesthesia, novocain locally, combined with brandy and glucose, is used. Glucose is used in preference to water; the babies like it better, and it is desirable for them to have the sugar. Eight cc. of a 1:8 mixture is instilled through the Levin tube, the tube is clamped off for five minutes, allowing for absorption, the clamp is removed, and the baby is allowed to suck a brandy nipple throughout the operation. This has proved very valuable. I would like to add here that this method is always used for gastrostomies which we do the day following the primary anastomosis of the tracheoesophageal fistulas. On all these babies a vein is exposed and a

1. Loc. cit.

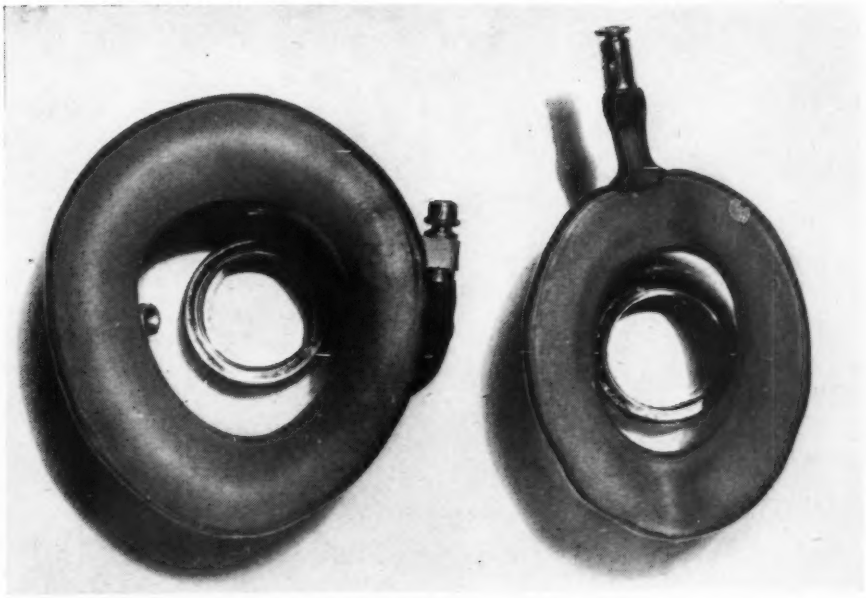

Fig. 1.—Child-size mask; from back to front it measures 2¾ inches, and from side to side, 2½ inches.

cannula tied in preoperatively, preferably under cyclopropane anesthesia, and if blood is necessary, blood and saline in equal parts are put in the buret and allowed to run in slowly. We found that whole blood was apt to clog the needle, and with this method the needle is most likely to stay patent.

EQUIPMENT

After using cyclopropane anesthesia successfully on the older children, the doctors asked that it be used on the newborn. Then came the problem of acquiring equipment suitable and to fit the baby. To-and-fro system on the Foregger machine is always used. Small masks were available, but none fitted the newborn well enough. One day I noticed that the alcohol shrank the celluloid mask. A child-size celluloid mask is shrunk in 70 per cent alcohol for about one week (Fig. 1). It becomes soft after soaking a short time,

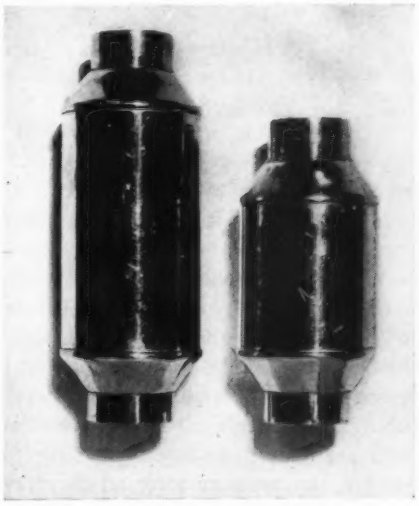

Fig. 2.—Small canister for soda lime, 4 inches in length.

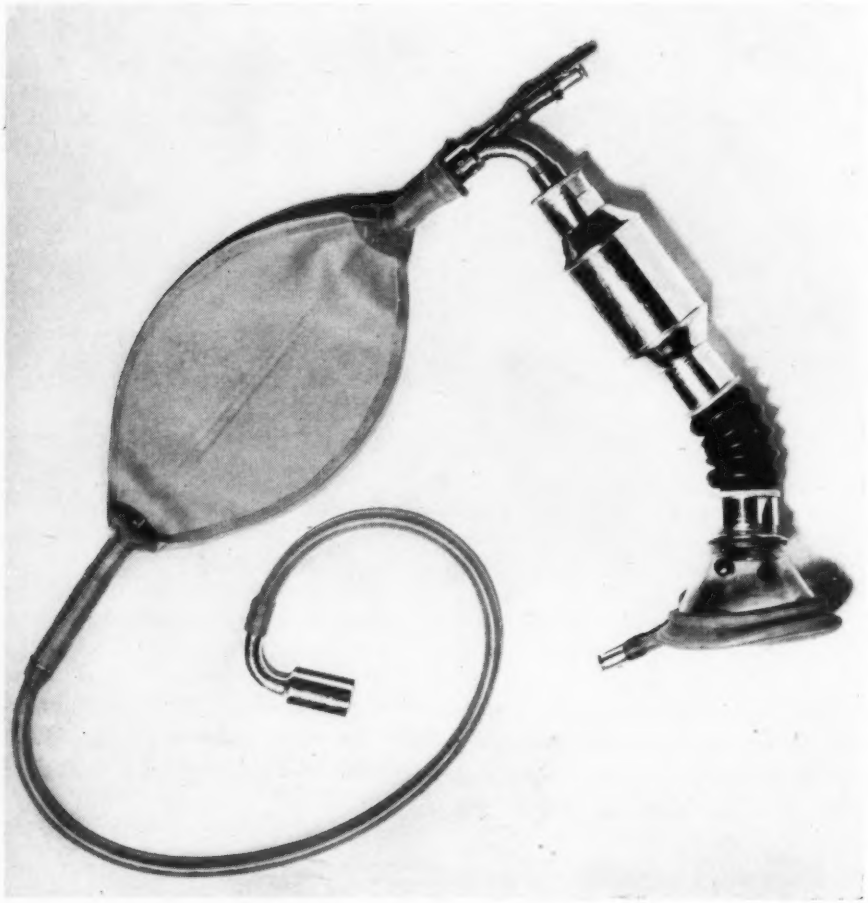

Fig. 3.—Corrugated tubing, 3½ inches in length.

so care must be taken to prevent its losing its shape. This type fits the newborn better than any other one tried. Next came the problem of a head strap, as those supplied by the companies were too heavy. These are made by the anesthesia department, using unbleached cotton with the small hollow penrose tubing; when this is in place, cotton balls are placed under the tubing to prevent any pressure sores on the very tender skin. One of our surgeons always looks a little wide eyed when the head strap is placed, but as yet we have had no ill effects. I might add here that after operation the face and head are massaged with cold cream. The smallest size canister that the catalogue shows is purchased, and our engineer cuts this down 1 inch (Fig. 2). A 1 L. breathing bag is used, and these, I am sure, any of the companies sell (Fig. 3). Smallest corrugated tubings are bought, and these are usually cut in half.

I am sorry to say that as yet none of the companies sell the small rubber

Fig. 4.—Demonstration of infant set-up.

airways. These, of course would be superior to the all metal, as the latter are apt to be fairly sharp, and caution must be taken to prevent any nicking of the tender mucous membrane.

Babies with these difficult anomalies usually have a Levin tube in before, during, and after operation. The problem arose as to how we could keep a closed system when the tube was coming from under the mask. A small hole in the side of the celluloid mask is bored just large enough for the tube, which is brought out before anesthesia is started and is sealed off with adhesive, making a perfectly adequate closed system (Fig. 4).

Figure 5 is presented, showing the difference in size of adult set-up and infant set-up for closed system.

In all open chest cases and in any poor risk babies, an infant Guedel laryngoscope, catheters no. 10, 12, and 14, which we make from ordinary catheters, and intratracheal connections are always in the machine cabinet.

TECHNIC

Patient, anesthetist, table, and machine are connected to one another with a Horton intercoupler. We do not use

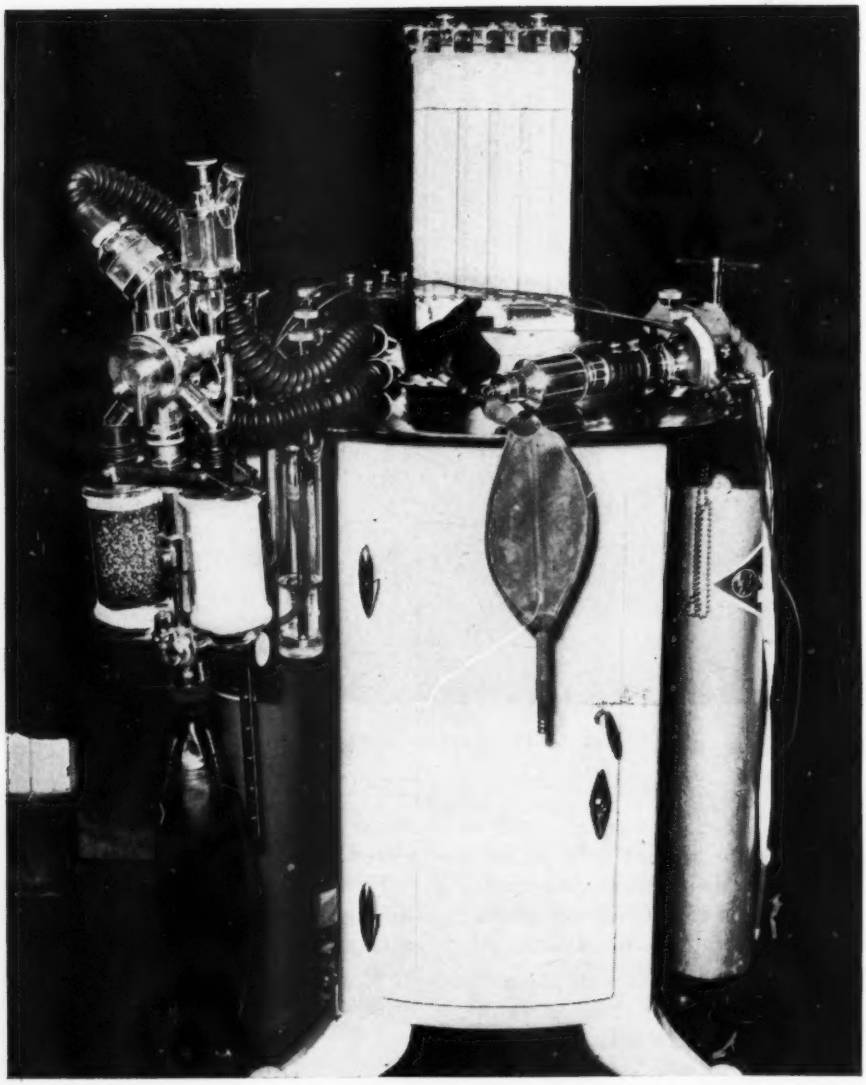

Fig. 5—Illustration to show difference in the size of the equipment for adults and that used for infants.

the intermittent method, but the continuous flow method is used. The machine is set, oxygen not less than 600 cc., cyclopropane 300-350 cc. The baby is put to sleep, airway placed, and then the head strap is fastened. This we do not fasten at the beginning of anesthesia as a number of anesthetists do. In the first place, it hurts; in the second place, it gets the patient very upset and restless. Perhaps we do lose some of the cyclopropane but not enough, if caution is taken, to do harm. After the baby is asleep, the oxygen is turned to 400 cc., the cyclopropane to 150 cc. until operation is underway, and then cyclopropane is turned down to 100 cc. per minute. We have found it a rare occasion when we could give less and have tried many mixtures and percentages but this has proved to be very satisfactory. I try myself and I teach my anesthetists that once the machine is set and everything is going well to leave it alone, not to turn gadgets just to give the impression that they are busy; that makes for poor, unstable anesthesia. It also upsets the surgeon, as he always seems to know every move that is made. As the skin sutures are being placed, cyclopropane is entirely closed and nitrous oxide and oxygen given for the remaining time. Nitrous oxide 500-750 cc. and oxygen 500 cc. is usually the mixture given. This is done not only to get rid of the cyclopropane but because it was found that, when cyclopropane was used to the end of operation, the patients had pallor, shallow respirations, and fall in blood pressure, due to the tissues' being filled with a very light gas. Nitrous oxide, being heavier, fills the tissues with a heavier gas, hence there is less shock, and the results have been gratifying.

When the mask is removed, invariably the baby cries lustily. This, of course, puts everyone in high glee as it is quite a sound to hear when the baby has just withstood a major, major operation.

POSTOPERATIVE CARE

The postoperative temperature of these babies sometimes is found to be only 94° F., and something has to be done quickly to raise the body heat. The Hess bed is used, which provides a uniform heat, as well as oxygen and suction. At present we are trying the Chapple bed, which provides everything required with the least possible handling of the baby. This has one great advantage over the Hess bed; it provides humidity along with all the other features. It also provides isolation. I have talked with the special nurses caring for these babies who are in the Chapple bed. They feel that the babies have a more stable postoperative course, which is so desirable.

SUMMARY

Cyclopropane anesthesia offers many advantages over other forms of anesthesia used in surgery of the newborn. It is less hazardous during operation, and postoperatively fewer complications arise. It is less exhausting, respiration is quieter, there is less fluid loss, and the induction stage is shorter. The patient is usually awake when the operation is completed, which is a great factor. Higher concentration of oxygen can be obtained; this is desirable in any patient but is especially important in the newborn.

ANESTHESIA IN CARDIAC SURGERY
The Blalock Operation

Merel H. Harmel, M.D.*

Baltimore

Thoracic surgery has made striking advances in the past 15 years. These advances have gone hand in hand and have been largely dependent upon improvements in anesthesia. As it became evident that patients could withstand long procedures with the pleural cavity open and that anesthesia could be adequately maintained as long as was necessary, it was a matter of time before the audacity of the surgeon led him to operate upon the heart and the great vessels. With this step the problem for the anesthetist has not visibly increased except for the necessity of more careful scrutiny of the patient and a keener understanding of the circulatory and respiratory adjustments that take place. The anesthesia technics which had been developed for thoracic surgery needed little if any modification for cardiac surgery. Since one of the major endeavors has been in the realm of congenital anomalies, a vast majority of the patients have been children. This meant an adaptation of adult technics to the child. It is, I know, an illusion of many anesthetists, and so it was our belief, that a closed technic cannot be employed in infants and children. We are grateful to Miss Betty E. Lank of the Children's Hospital, Boston, for helping to dispel that illusion. The closed technic has given us, I believe, the means for successfully serving the patient and the surgeon in the operative treatment of congenital heart disease in children. That success has heretofore been outstanding in the treatment of adults.

It is my purpose to tell you something of our experience in one of the latest contributions to cardiac surgery, the operative treatment of congenital pulmonary stenosis or atresia by Dr. Alfred Blalock. Up to the present over 200 patients have been operated upon. We have made an analysis of the first 100 cases comprising 103 anesthetics. The statistics quoted will be from this group. This condition is usually associated with the tetralogy of Fallot. The tetralogy of Fallot consists of (1) pulmonary stenosis, (2) a dextraposed aorta, (3) an interventricular septal defect, and (4) hypertrophy of the right ventricle. Apparently the principal difficulty of the patient with this anomaly is an insufficient flow of blood through the lung combined with inadequate aeration of mixed (arterial and venous) blood with resultant anoxemia and the whole train of alterations and adjustments in oxygen transport. Although this condition is compatible with life in some cases even into adult years, the majority of individuals so affected die in childhood and infancy. Those who

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Read at the Annual Convention of the American Association of Nurse Anesthetists, Philadelphia, Oct. 3, 1946.

*Department of Surgery, Division of Anesthesia, Johns Hopkins Hospital and University.

live are subject to varying degrees of incapacity depending upon the severity of the disease.

Patients who have come to operation present a most dramatic picture. Dependent upon the severity of their hypoxemia is a greater or lesser cyanosis. Mostly they are underdeveloped, frequently bedridden. They exhibit profound clubbing of the fingers and toes. All of them show dyspnea on exertion. As striking as is their outward appearance, blood and blood-gas studies are even more bizarre. The red blood cell count is greatly elevated, sometimes reaching 12,000,000; the hemoglobin content is often over 20 Gm. per 100 cc., and the hematocrit has been recorded as high as 90. Studies of the blood-gases reveal the oxygen content to be 13.7 per cent when 19.5 vol. per cent is normal, the oxygen capacity is 25 vol. per cent, and the oxygen saturation is consequently low, averaging around 50 per cent of normal. In addition the carbon dioxide–combining power of the blood is diminished. In the face of the polycythemia the viscosity of the blood is increased, and this is undoubtedly one of the important factors that play a role in the occurrence of cerebral thrombosis in these patients. Several patients have had cerebral accidents before operation. At necropsy it has been shown that many of these individuals have multiple organizing, organized and re-canalized thrombi in the lungs which further diminish the pulmonary blood flow. In most cases examination of the heart shows right-sided enlargement. Except for the patients who have gone into heart failure, there is no evidence of intrinsic disease of the myocardium, the only abnormality recorded by the electrocardiograph being unusually large P waves. However, it is obvious that the cardiac reserve is very poor. A number of these patients have died in the hospital waiting to be operated upon, and we have knowledge of several who have died en route to the hospital or at home awaiting admission.

It was the happy collaboration of Dr. Helen Taussig and Dr. Alfred Blalock which led to the performance of this operation in patients. In brief, what is done is the anastomosing of a peripheral artery, a major systemic vessel, the innominate, carotid, or preferably the subclavian artery to the side of the right or left pulmonary artery just before that artery divides. In this manner the stenosis is by-passed, and in effect a patent ductus arteriosus is created. This permits a greater flow of blood to reach the lung for aeration, and in consequence the oxygen saturation of the blood is increased and the patient dramatically improved. What does the anesthetist do while all this is going on? Let us begin at the beginning.

PREOPERATIVE CONSIDERATIONS

We early learned that these children are often spoiled and demanding. We found it most important to make the acquaintance of the patient before operation and so to pave the way for anesthesia room rapport. An anesthesia face mask may be used advantageously as a toy on the preoperative visit so that it will be a familiar, not a frightening, object. It is surpising how co-operative the small child will be when things are explained to him and the persons about him are not strange.

For preanesthetic medication we have preferred to use "heavy" doses of morphine and atropine, although nembutal and scopolamine have also been employed. It is very important that these

children be well sedated. Ideally we like to have the patient arrive in the anesthesia room quiet and tranquil so that if left undisturbed he will fall asleep. Excitement in these patients not only can precipitate severe attacks of dyspnea with cyanosis, convulsions, and loss of consciousness but may actually cause death. We usually have the drugs administered 1½ hours before induction. Only twice in the first 103 cases did we feel that respiratory depression due to morphine may have delayed induction of anesthesia. In the well sedated patient one notes that the cyanosis in the anesthesia room is less intense than previously. This probably results from the decreased psychic and metabolic activity with a consequent decreased oxygen demand.

Agent and Technic

We have found that cyclopropane has been most satisfactory for induction and maintenance of anesthesia. Vinethene and nitrous oxide have also been used for induction and ether for maintenance, but in our hands cyclopropane is the agent of choice, for we have been able to provide a quieter operative field more easily and successfully. To this end we have utilized the technic of controlled respiration whenever possible. Although it was used only 26 times in the first group of cases (103), it is now much more frequently performed. We have not been able to provide so quiet an operative field when ether has been the agent. Others may have better success in this matter. If it is impossible or possibly undesirable to obtain control of respiration, we have made it a practice, as soon as the pleural cavity is opened, to continually augment the respiration by applying positive pressure to the breathing bag a second or two before the patient inspires. This maneuver considerably diminishes the amount of mediastinal movement and paradoxical respiration. On 19 occasions when it was difficult either to control respirations or to cut down on mediastinal movement with intermittent positive pressure, rather than unnecessarily deepen the anesthesia we have administered morphine intravenously in doses of 1–4 mg. In all but a few instances an almost immediate slowing of the respiration occurred which enabled us to obtain a more quite mediastinum. Although the operation can be performed in the face of considerable movement if the surgeon is adroit enough, it is an enormous advantage to be able to work in an almost immobile field.

In only one case, the first, was the closed technic not employed. At that time we were of the opinion that the closed technic could not be used in infants, and the technic was open. Fortunately, the patient, a moribund infant 15 months old and weighing 4 kg., survived in spite of us. Since then, however, we have used the closed to-and-fro technic employing the Waters-Foregger anesthesia machine with small and medium-sized canisters of soda lime for infants and children.

In all but six patients an endotracheal tube has been inserted; the youngest patient was 10 weeks old. A Rovenstine connector, usually curved, joins the tube directly through a canister adapter to the soda lime canister and breathing bag. In children we had no difficulty in obtaining a tight fit without the use of cuffs or packs. I need not emphasize how important it is not to injure the delicate glottic tissues of infants or children. In our series there

were no instances of glottic edema severe enough to warrant tracheotomy. We believe that with this set-up not only is dead space cut down and greater minute-to-minute control of anesthesia achieved with a completely closed system, but also the anesthetist has the great boon of having both his hands free. On one occasion we used the T tube technic of Ayre. Although this technic makes the accumulation of carbon dioxide less likely, we have not been so sure of our control of the anesthesia. Those more experienced with this technic may find it perfectly satisfactory.

Attached to our anesthesia machine we have a water manometer with which pressures may be limited in a rough manner. In the first 85 cases in which pressure was measured, the average maximal was 11 cm. of water. However, since then we have rarely found it necessary to use more than 8 cm. of water. I must emphasize that we use the water manometer only as a safety valve and rough guide, for we feel that one's eye and sensitivity of touch are safer guides than any mechanical device.

MAINTENANCE OF ANESTHESIA AND COMPLICATIONS

Induction of anesthesia is generally carried out by the semiclosed technic with mask and bag alone. Following intubation, which usually is performed about five minutes after the onset of induction, a soda lime canister is introduced. On the whole, induction is rapid and smooth and not unlike that in patients with normal cardio-respiratory apparatus. Occasionally a patient requires what seems to be large amounts of anesthetic. Whether this is associated with the changes that take place in the lung or the degree of pulmonary stenosis or both we cannot say. If anesthesia does not progress satisfactorily, we have no hesitancy about cancelling operation. For example, on one occasion a boy, aged 1, developed evidence of severe bronchiolar constriction after a few minutes of cyclopropane; operation was postponed, and a week later after the beginning of a vinethene-ether sequence he again showed evidence of bronchiolar constriction. Again operation was cancelled, and it is planned to try ether alone at some future time. On another occasion a girl, aged 8, after a rather poor induction was found to be suffering from moderate obstruction due to a kinked endotracheal tube. The catheter was removed and reinserted. About five minutes after the reintubation she began to breathe in a gasping manner, and the pulse rose to 250 beats per minute. We assumed that she had developed auricular flutter, and operation was cancelled. Two and a half months later she was given nitrous oxide and ether instead of cyclopropane; during operation she had electrocardiographic evidence of almost every arrhythmia there is, including auricular flutter. She survived and is doing well. The whole point is that, if the patient is profoundly embarrassed before the onset of anesthesia, or during anesthesia before operation is begun, it is much the better part of wisdom not to add the great strain of operation unless the situation is desperate. There is no constant effect on the pulse rate during operation. The blood pressure has varied in no consistent manner except after the opening of the anastomosis, at which time it almost always takes a sharp dip of 10–20 mm. Hg, which is restored in about 10

minutes. Minor cardiac arrhythmias were noted in 12 anesthesias in 11 patients. These arrhythmias were transient and were of no apparent significance.

The most serious complication occurring during operation has been slowing and weakening of the heart beat. During the course of 39 cases this ominous sign occurred 5 times with ether, 19 times with cyclopropane, and 15 times when both agents were used together. It occurred shortly after the pleural cavity was opened on 18 occasions, twice before the pleural cavity was opened, 8 times during exploration of the great vessels, and 11 times during the anastomosis, which is we believe the most dangerous period, particularly in those patients with greater degree of pulmonary stenosis and physical disability. Fourteen of these 39 patients subsequently died, 3 during operation. Whenever slowing or marked irregularity occurs, if possible the operation is interrupted, the rib retractors are removed, and inflation of the lung is carried out, although we attempt to keep the lung as inflated as is compatible with the operative field. When slowing occurs shortly after the opening of the pleural cavity, the patient almost always recovers, and the operation is continued. On several occasions coramine was injected into the superior vena cava and sometimes directly into the auricles. In only 4 of 11 instances did we feel that there was an appreciable effect. In the belief that this slowing may have been related to vagus reflex activity, we attempted to block the vagus on the operated side, just after the pleural cavity was opened. The result of this procedure was unreliable. However, more recently we have been employing atropine in doses of from 0.1 to 0.4 mg. depending upon the size of the patient. This has been given intravenously at the first sign of slowing or irregularity. The response is immediate and striking. The pulse rate rises within three minutes to about 120 beats per minute, and one can feel the pulse become perceptibly stronger. Unfortunately, these results have not been tabulated as yet, and I can only give this to you as an impression.

The respiration may become irregular when the pleural cavity is opened or when the great vessels are explored if the anesthesia is light at this point. Exploration of the great vessels is undoubtedly the most stimulating part of the whole procedure. There is no regular effect on the respirations. If possible we abolish them with control. Of considerable concern to the surgeon is the sudden jerky type of respiration which may obtain and for which nothing can be done save dangerously deepening the anesthesia, which we have preferred not to do. In five instances, once with cyclopropane and four times when ether and cyclopropane were used, it has been thought that bronchiolar constriction may have been present. Temporary obstruction to respiration has occurred on occasion, and this has appeared to be related to traction either on the pulmonary artery or the trachea. There has been no instance of upper tract obstruction.

In 38 patients we have noticed a temporary deepening of the cyanosis, which has occurred at various stages of the operation after the pleural cavity is opened. However, in almost all instances in which a successful anastomosis has been completed, the color improves almost within five minutes after

the anastomosis has been functioning. Although the cyanosis is disturbing and sometimes alarming, operation has never been postponed on its account alone. Many patients go through the entire operation with no change in the pulse, respiration, or blood pressure and with no obvious complications. I must emphasize that the anesthetist must constantly watch the operative field. He cannot perform control or assist respirations properly without watching the lung and mediastinum. Not only this, but in a team the anesthetist must be constantly watching the heart with his eye as well as with his finger. Events happen suddenly, and one must be prepared to act quickly. It is known that the pulmonary artery may be entirely absent from one lung, the blood supply being wholly through greatly enlarged bronchial arteries. Clamping the one remaining pulmonary artery may be disastrous, so it behooves the anesthetist to observe carefully the heart during the application of the pulmonary clamp.

At the conclusion of the operation, the lung is gently inflated under direct observation; it is probably wise to perform this procedure at stated intervals during the operation as well. Ordinarily, as I pointed out, one need not exceed 8 cm. of water. When the lung has been inflated, continuous positive pressure at a somewhat lower level is maintained until the closure is complete. While closing, the surgeon inserts a catheter of large bore into the pleural cavity with which he aspirates air, via a three-way stopcock and 50 cc. syringe after an airtight seal is made. This obviates the necessity of exerting too much pressure from within the tracheobronchial tree. Meanwhile, the anesthetist gradually reduces the high oxygen concentration of the mixture and adds an inert gas, usually helium; air would do. This serves to provide a medium that will not be quickly absorbed from the distal alveoli. Finally the secretions are aspirated, and the endotracheal catheter is removed. In the majority of our patients, reflexes have returned, and many of them will obey simple commands before leaving the operating room. Those patients who do not recover consciousness within two hours after operation have not survived.

POSTOPERATIVE COMPLICATIONS

As a group, considering the risk involved, the magnitude of the procedure and the insult to the cardiorespiratory mechanics, these children have done very well postoperatively.

Seven of these patients underwent an exploratory operation, but no anastomosis was performed. Two of these patients died in the immediate postoperative period, one of heart failure presumably and the other in all probability of blood loss. On two occasions acute fatal pulmonary edema has occurred immediately after operation. It is surprising that this has not happened more frequently. Subsequently another case developed at the close of operation, apparently from a rapid, uncontrolled venoclysis. This patient recovered. Pulmonary edema, associated with heart failure, has occurred in other patients from 1 to 20 days. Treatment of the heart failure usually cleared up the edema.

Over half of these patients had pleural effusion, usually bloody, for which thoracentesis was done. In 11 of these patients air as well as fluid was present. In addition there were five cases of tension pneumothorax, twice in one patient

after each of two operations. Three of these patients died. The cause of the pneumothorax is not clear at all. Thoracentesis frequently preceded the discovery of air. It is true that pneumothorax and tension pneumothorax may be a sign of pulmonary interstitial emphysema, that entity so beautifully delineated by the Macklins. As they have pointed out, the event may be initiated by coughing in the normal person, and it may be brought about by sharp increase in intrabronchial pressure such as might conceivably occur during anesthesia. With a collapsed and possible damaged lung, the stage is set. It is hard not to try to overcome an obstruction with just a little more squeeze on the bag. Furthermore in children, with the small tubes used, a small amount of secretions may constitute a sizable obstruction to outflow, which would mask the real pressure that exists behind the obstruction. We certainly must hold ourselves to blame for this complication, although it may not be so. Four other patients showed signs of pulmonary interstitial emphysema, exhibiting pneumomediastium, and subcutaneous emphysema.

The most serious and dreaded complication aside from severe tension pneumothorax was the occurrence of what we thought was cerebral thrombosis in 15 patients. Another patient showed evidence of a cerebral accident immediately after operation. It is significant that 14 of these 16 patients has some interference with the carotid or innominate arteries. In only 2 of these 16 patients was the subclavian artery alone involved. In an effort to avoid this dread complication several measures were tried. At first bleeding with plasma replacement was conceived to reduce the viscosity of the blood. But we have learned that these patients need all the whole blood that they have for operation. Dicumarol was administered to 28 patients, but after 1 patient died five days postoperatively of an obscure intrapulmonary hemorrhage, its use was discontinued. Heparin is now begun at the first sign of thrombosis. However, the incidence has dropped off sharply since the practice has been to use the subclavian almost exclusively.

Six patients, in spite of vigorous penicillin therapy, developed pneumonia, but in only one of these was it a serious complication. In 18 instances patients with recent acute upper respiratory infections were operated upon, for it was considered that to delay might be fatal.

Deaths

Of the 100 patients, 23 died. Of these 23, 5 died in the immediate operative period. The two patients with acute pulmonary edema have been mentioned. Of the other three, one was a very poor risk, an infant, aged 10 weeks, who suddenly died just as the anastomosis was completed 2½ hours after the beginning of anesthesia; the second was a boy, aged 5, weighing but 5 kg., who died during the exploration just prior to the beginning of anastomosis; the third patient was a girl, aged 8, who had been doing very well, only to die suddenly during the anastomosis. The remaining 18 patients died of a variety of causes at varying intervals during the postoperative period. We have mentioned the three deaths from tension pneumothorax. Four patients died of cerebral difficulties; four patients died of postoperative hemorrhage; two patients probably died of heart failure

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THE CHALLENGE TO THE NURSE ANESTHETIST

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The challenge to the nurse anesthetist is the over-all challenge in the normal life history of a profession: birth, growth, production, reproduction, maturity, and death (at least of individual persons and technics). This challenge has assumed many aspects and will show many more, but some challenge is always part and parcel of the normal life history of a profession. At first there is the arduous and frequently drawn out phase of labor in which the profession is born. You have advanced well into the growing stage; you are in heavy production of service. You are now entering the reproductive stage in which we see schools for the nurse anesthetists and the thirteen year organizational effort of the American Association of Nurse Anesthetists. You now are having children, and the natural processes of your life history bring you face to face with maturity and the challenge of the possibility of death, not only of individuals and technics but with the continuing existence of the profession itself.

May I substantiate what I have told you relative to the parts of your life cycle already passed, or in which you are now living, by quoting from a monograph written by Evarts A. Graham, which was published in *Studies in the History of Science* and given at the University of Pennsylvania Bicentennial Conference. Dr. Graham states:

"In the early days and until well into the twentieth century the conduction of anesthesia in this country was for the most part very bad, as judged by present-day standards. The methods of administration were crude, but the anesthetists were even cruder. For some curious reason it was felt that any doctor without even any previous training would be competent to administer a safe and satisfactory anesthesia, although scarcely any instruction in the medical schools was given. In nearly all hospitals the internes were the anesthetists, and this highly dangerous and technical procedure was entrusted to the newest and youngest internes at that. The only thing good about that system was that it furnished a good training to the surgeon in the control of his emotions. Many tragedies occurred. The wonder is that there were not more. At the time of which I am speaking the doctors in the United States were not interested in specializing in anesthesia. There were one or two here and there but their number was insignificant. . . . In recent years more and more doctors have taken up anesthesia (or anesthesiology) as a career, and this is as it should be. The American Board of Anesthesiology which awards certificates of proficiency to medical specialists in this field demands as prerequisites a rigorous training of several years and the passing of an examination."

May I comment here that physicians were not then interested in anesthesia. In fact, it is my sincere belief that physicians themselves are responsible for the nurse anesthetist. I quote again from Dr. Graham's address:

"Realizing, however, that something must be done to correct the state of affairs in this

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country [Until well into the twentieth century doctors in the United States were not interested in specializing in anesthesia. There were one or two, but the number was insignificant.] specially selected graduate nurses were given instruction in the art of anesthesia about 1907 by Dr. George Crile and the Mayo brothers. At the Lakeside Hospital, Cleveland, shortly after the first World War a school for the training of nurse anesthetists was created. Since the creation of that school hundreds of nurse anesthetists have been trained not only there but in other similar schools as well."

Now today the medical profession sees the success of the nurse anesthetist, and there has emerged competition on the part of physicians. As Dr. Graham states, "in recent years more and more doctors have taken up anesthesia as a career." Competition is simply one of the challenges of the normal life history of a profession. No sooner is an idea, organization, or service born and starts to grow, produce, and become successful than competition immediately enters the picture. It is a peculiar thing that we must fight to be born and fight to grow, and, as soon as the processes and service for which we fight are working and are successful, we must immediately prepare for competition. Dr. Graham takes cognizance of this challenge:

"Whether or not in time the nurse anesthetist will disappear it is impossible to say. Certainly at present the number of medical anesthetists is grossly inadequate to fill the needs of the country."

Here I should like to point out that the last sentence offers the hope that the challenge can be met.

How can the nurse anesthetist meet this challenge? First, and this is basic human psychology and well documented by history, give good service of high quality at a cost that is not prohibitive. Another version might well be to make yourself indispensable. Certainly the medical profession is aware and most sensitive to the high quality service being rendered, and there is at present a definite reluctance on the part of physicians to engage in any specialty which is not primarily connected with the dramatic treatment of acute diseases and accidents. It is well known that graduates in medicine take up the specialty of anatomy, physiology, or pharmacology or administrative specialties, such as the deanship of medical schools and hospital administration, in small numbers. Frequently it is necessary to draft well trained physicians for those specialties because so few enter them of their own volition. If that statement be reasonably true, then as long as the nurse anesthetist is well trained and produces anesthesia in quantity and quality at a cost that is not prohibitive to the public, it is my sincere conviction that the medical profession and hospitals will use the nurse anesthetist. The idea of furnishing services at a cost that is not prohibitive involves the salary paid the nurse anesthetist. The nurse anesthetist should be well paid, but should her remuneration approach that of the medical profession, it does not take too great a degree of intelligence to realize that more physicians will be attracted to the specialty of anesthesiology. Therefore, a careful balance must be maintained between the adequate salary of the anesthetist and the remuneration of the average physician in practice. This principle is not new but is simply the application of the law of diminishing returns.

Another economic law that functions inevitably is the law of supply and demand. If the number of nurse anesthetists is adequate, there will be no great incentive to increase the number of qualified medical anesthetists. If that

reasoning is correct, it behooves us to have a sufficient number of good schools turning out nurse anesthetists in sufficient numbers. In order to have more and better schools it is now necessary to have an approval and standardizing body for our schools. To date there has been no such organization. The American College of Surgeons, the American Medical Association, the American Hospital Association, and the Association of Nurse Anesthetists studiously avoided taking the responsibility for approval and standardization. Now your organization has taken a courageous step at Cleveland and has set up a mechanism for approving schools of nurse anesthetists, which was approved at your business meeting yesterday morning. This is of great significance and will give your organization stature and authority.

Let us return to the question of service and quote once more from Dr. Graham's address:

"By this movement [the training of nurse anesthetists] the administration of anesthetics in most of the hospitals in this country was vastly improved. Permanent professional anesthetists, albeit nurse, were substituted for the incompetent and casual interne ether-pourers. The tremendous benefit to surgery which the nurse anesthetist has been and still is can hardly be overestimated. Because of her, even the smaller hospitals can now have reasonably safe and satisfactory anesthesia."

It would seem that the nurse anesthetist would be relatively secure if you were to maintain that level of service, but operating as a challenge is the aggressive attitude of the medical profession, most of whom are now members of the Board of Anesthesiology. This competitive action on the part of the medical profession is thoroughly understandable and, as far as the public is concerned, desirable. The nurse anesthetist need not be too alarmed if she will abide by the general principles which we have laid down. The trend of medical practice, the effect of scientific research, and, above all, the trend of public reaction toward medical care indicate definitely that the hospital is becoming the center of medical care. Today hospitals are the sixth or seventh largest industry in the United States, and it is safe to predict that within the next decade hospitals will multiply very rapidly.

It must be pointed out that in the larger hospitals and teaching hospitals affiliated with medical schools it is desirable to have a trained medical anesthetist responsible for the training of medical students, but there is still a place for the nurse anesthetist, probably in the ratio of 10 : 1.

May we return to the consideration of the medical anesthetist in hospitals affiliated with medical schools. This specialist should be the liaison between physiology, pharmacology, and applied anesthesia. This is essential for research and for testing new agents on laboratory animals. It will also be possible to give the student nurse anesthetist the theoretical phase of her training, and the nurse anesthetist would be responsible for the routine administration of anesthesia and for the routine training of the student nurse anesthetist. Thus in the hospital the medical anesthetist would be responsible for the training of the interns, residents, and medical students. The chief, or administrative, nurse anesthetist would be responsible for the training of the student nurse anesthetist. As the hospital becomes the center of medical care, there is a great need for medical anesthetists in

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TESTING AND GENERAL INFORMATION TESTS

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The following discussion will deal with the nature and use of tests. Tests may be divided into several different groups or kinds. Among these are educational, achievement, interest, and intelligence tests. The first, educational tests, is the kind that is given in the schools in any school subject to determine just what we may expect from any group. This kind of a test may be made up by the teacher, or it may be a standardized test. A standardized test is one which has been carefully constructed and has been given to groups, and on which norms of accomplishment have been determined.

Next, there is the achievement test which measures an individual's achievement in stenography, architecture, or any other field. The educational test is one form of the achievement test in school subjects. But achievement tests may include a much larger field than educational tests.

Third, we have the interest test. The purpose of this type of test is to measure the interests of an individual, i.e., whether he has the interests of a lawyer, a carpenter, or a banker. The Strong Interest test and the Kuder Preference Record test are examples of this type.

Then, we have the intelligence test. In 1904, Alfred Binet, a psychologist, and Theodore Simon, a physician, were given a special job of deciding what children in the Paris schools needed special instruction. It was recognized that there was a difference in people, and it was Binet's and Simon's job to find out what those differences were so that something could be done about it. It was not their job to construct an intelligence test, but rather to find out what children in Paris schools needed special help. They did, however, construct the first successful intelligence test. Two or three general principles were used by Binet and Simon in constructing their tests. First, they used the age-grade idea. Their task was to find a series of questions and problems that a typical 4 or 5 year old child would be able to answer, but that a younger child would not be able to do. This was the first time the age-grade idea was recognized and made a part of an intelligence test. In making up their test, Binet and Simon selected things that made up every day experiences and deliberately tried to avoid things the child would learn in school. For example, they asked the children to count from 20 to 1 instead of from 1 to 20. It was because of the use of these principles that the Binet and Simon intelligence test was so successful.

There is considerable difference of opinion as to how intelligence should be defined. Stern has defined intelligence as the ability to meet and solve new situations. In other words, the ability to utilize material from old situ-

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ations and apply it in new situations is an indication of intelligence.

Freeman's definition is, "Intelligence is the ability to learn." However, it is important what we learn. This fact indicates that there are different kinds of intelligence. One kind is the ability to learn to get along with people. Thorndike calls this type of intelligence social intelligence. There is also what we call mechanical intelligence. This is the ability in any special trade such as repairing an automobile or building a bridge. Mechanical intelligence, then, is the ability to handle tools and instruments.

By general or abstract intelligence we mean roughly the ability to learn in the field where symbols are used. In other words, ability to learn mathematics, language, history, or any other subject in school or college in which the principal factor involved is a symbol. We mean by intelligence tests, then, some kind of questions which will measure as best we can the ability of a person to learn symbols. We have to find out whether that person has the ability to deal with symbols, either to a large degree or to a relatively small degree. People differ greatly in such abilities.

It is important in industry in selecting workers and people for the higher types of jobs and even executive positions, where real thinking is involved, to know whether the applicant for such a job possesses a high degree of intelligence. The amount of intelligence required, of course, differs with different kinds of work.

There are two kinds of intelligence tests, the one is a group test, and the other, an individual test. The individual test is one that cannot be given to more than one person at a time. The Binet test is an individual test. The individual test is almost always the best kind to give if you have the time to give it. This type of test, however, requires very special training on how to give and score it.

The group test can be given to a group of people at the same time. It can also be given to an individual, but it is still known as a group test. It does not require special preparation as does the individual test and is taken and scored according to printed directions. The matter of how to give and how to score takes no special training for anyone who is willing to follow the directions.

The most common type test is the pencil and paper test. As the name implies, the test is taken with the use of a pencil and paper. There is another type, called a performance test, in which no writing is required.

The performance test is used especially for persons who do not have a knowledge of English. This type of test is never so good as the pencil and paper test for measuring general intelligence. However, for persons who are deaf or illiterate, the performance test is the only kind to use. Most mechanical tests are performance tests. In this field performance tests are very satisfactory.

Tests are also classified as speed or power tests. Speed tests are tests where there is a definite time limit. The questions in such a test may be arranged in the order of difficulty, but do not necessarily have to be. In speed tests there is always a time limit which generally prevents some persons from completing all of the test. If, on the other hand, the questions in the test are ar-

ranged in the order of difficulty, that type of test is known as a power test. There may or may not be a time limit, and, if so, it is not an important factor. The general classification test that was used by the Army in the World War II was a combination of the speed and power tests.

In most general intelligence tests, a language factor is an important part. Professor and Mrs. Thurston, pyschologists at the University of Chicago, have done more work than anyone else on the material that should go into intelligence tests. They have found that a language factor is very important. The person who can define words and use many words is always an intelligent person.

Mathematics is another factor which should be included in an intelligence test. A knowledge of simple mathematics and ability to add, subtract, multiply and divide, and work problems are very important. It is important in our every day living and in our modern civilization to be able to use mathematical symbols. Persons should know what such symbols mean and how to use them. The Army general classification test is composed of language, mathematics, and tests of space perception.

People differ greatly in general intelligence. Generally, we say that those individuals who are in the lower 2 per cent, or who have an I.Q. below 70, are feeble-minded. For example, of the 8,000,000 people in Illinois, probably about 160,000 are feeble-minded or are near this level. The very best of that group when they become of age will have the intelligence of an average child of about 10, or will not be able to do much more than read a newspaper.

There are also approximately 2 per cent of normal groups who are geniuses or near geniuses. There are, for example, many boys and girls who at age 10, if they have had normal training, are ready for high school. Even the poorest of them when they are 10 are equal in ability to a 13 year old child, and the best of them are equal in ability to a 17 or 18 year old child. Also, about 160,000 in the state of Illinois are in this class.

What can bright persons do? They can do well in high school or college and do well in life problems and average life situations. Many studies, one by Walter Gifford of American Telephone and Telegraph Company, have shown that there is a high correlation between ability and industrial success. However, such people may also become criminals. There are just as many persons in penal institutions with high intelligence as there are with low intelligence. Years ago it was said that the cause of criminology was the lack of intelligence, but that is not the case. There is no correlation between ability and living up to moral standards.

What explains intelligence? Does it measure native ability? Is intelligence inherited, or is intelligence influenced by environment? Professor Terman of Stanford University believes that intelligence is almost entirely a matter of inheritance. On the other hand, President Stoddard of Illinois and Professor Wellman of Iowa have done considerable experimental study that convinces at least a large majority of us that intelligence test scores are influenced one way or another by environment. Gladys Swesinger has stated that she believes that we are born with a certain range of capacity. Some people are born with a

high range and others with a low range. Each of us has his own range, and whether he is in the high or low part of that range is determined by his environment, especially his early environment.

A study was made of 140 children of illegitimate birth who were placed in foster homes. Before birth, the mothers were placed in a hospital and given care. Approximately one half of the group of mothers were given an intelligence test. The average I.Q. of that group of mothers was 87. This is low but not feeble-minded. There were very few below 70. Two of the mothers tested had gone to college, but none of them was a college graduate. No child was used in the test whose father was not known. Their socioeconomic status indicated that they had about the same intelligence as the mothers. After a very careful study of the homes was made, the babies were placed in foster homes. The homes were carefully selected on a basis that the children would have an unusual opportunity for a favorable environment. After having been placed for a few months, every child was given an intelligence test. The average I.Q. of the 140 babies was 117. This proved that association in the better and more stimulating homes produced a higher intelligence. Some children, though, are predestined to have low intelligence, and not even the influence of a good home will produce a good I.Q.

There are two criteria for the selection of a good intelligence test. One, is it valid? This is another way of saying, does it measure what it is supposed to measure? Two, is it reliable? If you gave the same test over again, or another form of the test, would you get approximately the same score? A good test should have a validity of not less than 60. It should have even a higher reliability than validity.

Intelligence tests are recommended in two different connections in the work of your association. First, in your training schools intelligence tests should be used in the selection of candidates for your schools. They should be one of the factors in determining whether or not the candidate should be accepted. In addition to intelligence tests you should find out what kind of background the individual has and whether he is prepared. Interest and personality are important factors in choice of candidates. Is the person emotionally fit? Is he socially fitted for your kind of work? As just stated, there are several things that should be considered in selecting candidates. One of these, and the most important, is, does the person have the ability to learn what is taught in your institutions? There are many good intelligence tests. The American Council of Education test is a good test. Also, the Ohio Examination, Army Classification tests, or the Otis Test is recommended for a shorter time limit.

Second, we recommend that intelligence tests be used as part of examinations for membership in the association. For such use, it ought to be one of the shorter tests, such as the Otis Test. Intelligence tests should be given in connection with the qualifying examination; it is important to know the relative merits of the candidates from different institutions, and the scores made on intelligence tests are a fairer measure of quality of candidates from any institution than the written examinations. Intelligence tests measure

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ANESTHESIA: LEGAL AND ILLEGAL

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Broadly speaking our laws come either from the legislatures or the courts. When we speak of the legislatures, we may have in mind one of several bodies: The Congress of the United States makes laws; state legislatures and local governmental units, such as municipalities, also establish laws and ordinances.

When we refer to the courts, we may mean the United States Supreme Court, the United States Circuit Court of Appeals, the United States District Court, or, perhaps, a police court, a municipal court, city court, county court, state supreme court, or some appellate court.

Aside from these sources of law, there are administrative bodies which adopt rules and regulations and which have the authority to enforce them. Ever growing in number, these laws control many of our social and business activities and the complicated society in which we live. Federal and state statutes, local ordinances, common law decisions based on legal tradition or interpreting the significance of statutes or ordinances make up our tremendous body of law.

It may come to you as no surprise that there are also legal aspects to the practice of anesthesiology; in respect to anesthesia administration the law is not stagnant; it changes from time to time and receives certain refinements as a result of legal decisions. These opinions result from lawsuits involving malpractice claims by patients against physicians, nurses, and hospitals, and these are not few in number. Various organized groups sponsor legislation designed to control or regulate anesthesia administration. That there may be some merit to some of the proposed laws cannot be denied when they have for their object the improvement of anesthesia service and the protection of the public. On the other hand, professional pressure groups try to have laws enacted which are primarily intended to benefit a particular body rather than the public at large.

The American Nurses' Association recognizes the value of keeping an eye on legislation; two committees carry on this work, one dealing with federal legislation and the other with state legislation. The American Hospital Association has a bureau in Washington which keeps its members informed of federal legislation; various state organizations of hospitals are vigilant in watching the laws that are introduced in the legislatures. One state organization has the services of a lawyer to inform and advise its membership on legal matters of collective interest to the hospitals of the state, particularly in connection with proposed statutory changes.

Some of the bills which are sponsored in the legislatures deal with the

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administration of anesthesia and the use of general anesthetics. For example, early this year there was introduced in the New York State legislature an act which would restrict the use of anesthetics employed by dentists to "qualified dental assistants," who would have had an approved course of training, or who have had approved experience, in the administering of anesthetics. An approved course of training would be one approved by the Board of Dental Examiners; those certified on the basis of experience would file a certificate attesting to such training or experience. All persons certified would be required to have at their disposal at the time of administering any general anesthesia the necessary drugs, medicines, and equipment for resuscitations as the Board of Dental Examiners shall prescribe.

Whether or not such a law would be of benefit to the public may be debatable. However, a newspaper statement appeared shortly thereafter by one of the leaders in the dental profession advocating an amendment to the bill so as to require all persons administering anesthetics to be so licensed.

The role of the nurse anesthetist has been open to criticism and to skeptical scrutiny because it is in its initial stages. In many hospitals she is to be found alongside the surgeon, administering anesthesia with practiced skill. More and more nurses are turning to the profession of anesthesia as their field of specialization.[1]

One objection to anesthesia administration by a nurse is that in so doing she practices medicine. That the administration of anesthesia in which dangerous compounds are used is medical care per se is beyond question.[2] It is also true that a license as a registered nurse does not authorize her to practice medicine,[3] for nursing is confined to the performance of professional services in carrying out treatments prescribed by a licensed physician.[4]

The practice of medicine consists of three things: first, in judging the nature, character, and symptoms of the disease; second, in determining the proper remedy for the disease; third, in giving or prescribing a remedy for the disease. If the person who makes a diagnosis also prescribes the medicine for the patient, he is practicing medicine.[5] However, the mere giving of medicine, prescribed by the physician in charge, who has made a diagnosis and who directs the manner, time, and character of the medicine to be administered, has never been considered the practice of medicine. By the same token, a nurse administering a prescribed anesthetic to a patient in the presence of, and in accordance with the directions of, the surgeon in charge does not engage in the practice of medicine within the meaning of that term.[6]

Many states now regard anesthesia as the practice of medicine. The tendency, however, is toward a liberal rather than a strict interpretation of the law. This liberalization allows a nurse or technician to act as the agent of a qualified practitioner. However, the surgeon assumes all responsibility for her ac-

1. Costello, M. A.: Anesthesia — a challenge to nurses. Am. J. Nursing 44:745-746, August, 1944.

2. Matter of Marks v. Mangan, 261 App. Div. 668 (N.Y.).

3. Education Law, ch. 785, Laws of New York.

4. Education Law, sec. 1374 (2), Laws of New York.

5. Underwood v. Scott, 43 Kan. 714, 23 P. 942.

6. Frank v. South, supra.

tions, and the fact that the anesthetist is a registered nurse does not relieve him of responsibility.[7]

It is the right of the physician or medical anesthetist, not that of the nurse, to select the anesthetic and insist upon his own choice of preoperative sedation and opiate. In the operating room, only he may make a minute-to-minute diagnosis of the patient's condition and prescribe such treatment as the diagnosis warrants. He is the one to keep check on the patient's blood pressure, pulse, and respiration. His right to diagnose and prescribe distinguishes his functions from those of the nurse anesthetist.[8]

A number of judicial decisions have considered the legality of anesthesia administration by nurses. In one case, two surgeons brought an action to restrain a registered nurse employed by a hospital from administering general anesthetics, claiming that such procedure constituted the practice of medicine. At the trial it was shown to be the recognized procedure in hospitals to permit nurses to administer anesthetics and hypodermics under the immediate direction and supervision of the operating surgeon. The court declared that nurses in the surgery in preparing for, and during the progress of, an operation are not diagnosing or prescribing within the meaning of the medical practice act when they are carrying out the orders of the physicians to whose authority they are subject.[9]

A surgeon sought to have his licensed nurse permitted to give anesthesia to his patients. It appeared that she had more than six years' nursing experience, had made a special study of anesthesia, and had administered anesthetics to more than 1,200 patients. In each case, the surgeon had selected the anesthetic and supervised its administration. On these facts the court concluded that the nurse was not practicing medicine, but was exercising her profession within its proper limits.[10] Supervision by the surgeon is the controlling element which removes the procedure from medical practice.

The bill of a dentist for the administration of cocaine, morphine, and other drugs for an incurable cancer of the mouth was objected to on the ground that he was not legally qualified to practice medicine. Since the dentist had administered the anesthetic drugs and treated the cancer under the instructions of a licensed physician, the court said he functioned as an ordinary nurse.[11]

Suit was brought by a dentist to have a declaration made by the court as to his right to employ a registered nurse who had taken a prescribed course of anesthesia at a hospital in good standing to administer anesthetics to his patients, under his direction and in his immediate presence. The question was whether such administration by a registered nurse of the character described, under his supervision, is permitted by the laws of Arizona.

The state statute provided that a registered nurse may administer anesthetics under the direction and in the immediate presence of a licensed physician or surgeon, provided such nurse has taken a prescribed course of anesthesia at a hospital in good standing or

7. Margiotti, C. J.: A lawyer views anesthetists. Modern Hosp. 49:51, November, 1937.

8. Brown, H. J.: The medical anesthetist. Modern Hosp. 55:71-72, July, 1940.

9. Chalmers-Francis v. Nelson, 57 P. 2d 1312 (Cal.).

10. Frank v. South, supra.

11. In re Carpenter's Estate, 196 Mich. 561, 162 N. W. 963.

is a graduate in the science of anesthesia administration from some recognized school or college.

Since dentists were permitted by law to use anesthetics, the court held that the term surgeon applied both to physicians and "dental surgeons" and that qualified nurses could act under their direction.[12]

It must be conceded that the laws dealing with anesthesia are primarily for the benefit of the patient and not for those who participate in his treatment. That anesthetics are dangerous drugs when administered by incompetent persons requires no argument and is not subject to debate. Court records report a considerable number of lawsuits in which judges have pointed out the responsibility of the surgeon and anesthetist in this field of medicine.

The physician has the right to assume that the nurse employed by the hospital is competent. He is not chargeable with her incompetency unless it is shown that he was aware of her lack of experience and skill. A duty rests upon him, however, to give proper instructions to the nurse, except as to her ordinary duties.[13]

If the surgeon himself selects the anesthetist, he is expected to exercise the same degree of knowledge, skill, and care in the choice as he is required to display in the performance of any part of the operation.[14] During the course of the operation, when a patient is under anesthesia, the surgeon must see that no preventable injury occurs to him.[15]

For the failure of the nurse and surgeon to examine the anesthesia apparatus during the operation, thereby resulting in the administration of an excess amount of ether, which in turn required the removal of the patient's adenoids to relieve his lungs, they may be held personally liable.[16]

Liability of Nurse Anesthetist

Generally speaking, the nurse anesthetist who merely administers an anesthetic to a patient is not liable for the negligence of the operating surgeon.[17] During an operation, excessive uterine bleeding necessitated the performance of a laparotomy. Gauze was placed in the uterus, but it was not removed at the termination of the operation. No liability attached to the anesthetist because it is the rule in surgical operations that the anesthetist is directly chargeable with the physical condition of the patient; her attention must be directed solely to the task of administering the proper amount of the anesthetic and continuing to supply it in just such proportions as will insure the patient's remaining in a comatose condition while the operation is on.[18]

A physician or surgeon is not necessarily liable for malpractice because of a bad result in the administration of an anesthetic. He acts on his best judgment, and when he does so, he is not liable for injuries arising without his negligence. However, the mere fact that he used his best judgment does not absolve him absolutely of responsibility for any injury he may cause; the circumstances may be such as to show he was negligent. For example, he might be honest in his judgment in feeling that he could leave certain details to

12. State v. Boran, 76 P. 2d 757 (Ariz.).
13. Morrison v. Henke, 165 Wis. 166, 160 N. W. 173.
14. Frank v. South, 175 Ky. 417.
15. Aderhold v. Bishop, 94 Okla. 203, 221 P. 752.
16. Stonaker v. Big Sisters Hospital, 2 P. 2d 520 (Col.).
17. Robinson v. Crotwell, 175 Ala. 194.
18. Jett v. Linville, 202 Ky. 198, 259 S. W. 43.

an assistant and yet be liable for negligence in doing so.

He is liable if his mistake of judgment is so gross as to constitute negligence. If a surgeon persists in the use of an anesthetic after a warning or indications which should impel one of reasonable prudence to desist, he is answerable for the consequences.

Plaintiff's intestate, a young man in good health, submitted to a tonsillectomy, under ether. The ether used was manufactured by a drug manufacturer. He failed to recover from the administration of the ether. Plaintiff charged the surgeons with malpractice and the drug company with negligently putting on sale ether unfit for use.

One of the defendant-doctors testified that during the operation the patient came out rather quickly from the ether and had to have more; that he seemed to resist every time the doctor tried to remove the tonsils. The patient would become cyanotic, and the anesthetist would raise the mask until the condition passed away and then repeat the anesthetic. This continued for over three quarters of an hour.

Here the doctors early discovered the pernicious effect of the ether but persisted in its use and also failed to give proper care to the patient after the operation. There was expert evidence that impurities were found in an analysis of the gas which may have been produced from oxidation of the ether. Whether it was so negligently prepared and sealed by the manufacturer and whether it was so sealed and kept in the hospital were for the jury to decide. From the testimony of the surgeons, and from common knowledge, the jury might infer that, if the doctors had desisted from the use of the ether at the first sign of danger, decedent's life might have been spared. The verdict against the drug company and the surgeons was affirmed.[19]

For reducing a fractured arm of a 17 month old child, the surgeon administered chloroform. Before the operation was completed, the child died. The father offered evidence to show that death resulted from the negligent administration of the chloroform. Defendant contended that the mere administration of chloroform to persons in a certain rare and obscure pathologic condition is sufficient to cause death and that the fracture of a bone may cause a fatal embolism. His claim was that the death may have been due to the child's condition or may have been the result of the fracture, that plaintiff failed to prove that defendant's negligence was the cause of death and also that there was a failure to perform an autopsy to ascertain the cause of death.

The jury's verdict in favor of the father was upheld. "It is common knowledge that death does not ordinarily follow the proper administration of an anesthetic, or immediately result from a fractured humerus." The father was not bound to exclude all possible causes of death but only had to show that one was more probable than another. There was enough evidence to sustain the findings of the jury, who could draw inferences from the fact that neither party asked for an autopsy.[20]

Ordinarily, where there is conflicting evidence as to the cause of death, the disputed questions are passed upon by the jury. A complaint was dismissed

19. Moehlenbrock v. Parke Davis & Co., 141 Minn. 154, 169 N. W. 541; 145 Minn. 100, 176 N. W. 169.

20. Boucher v. Larochelle, 74 N. H. 433, 68 A. 870.

where the experts all agreed they could give no definite opinion as to the cause of death. In that case, three persons were present at the time of the administration of the chloroform; the son of the deceased and two doctors. A postmortem examination showed the patient died of calcareous degeneration of the heart. Experts called by both sides could not state the cause of death. "This is not a case of conflicting expert testimony, where upon one side the doctors swear that the death was caused by suffocation produced by the use of chloroform, and on the other side the doctors swear that the death was caused by calcareous degeneration of the heart, and where possibly it would be left to the jury to determine as to who was correct. When this is the condition of the evidence of the physicians, how could a jury reach any determination as to the cause of death." The judgment in favor of the administrator was reversed and a new trial ordered.[21]

Nembutal in a glass of water was given by a dentist to a patient; about one-half hour later the patient was seated in the dental chair, and the dentist administered a mixture of nitrous oxide and oxygen, which brought him under in a minute. Patient then became cyanotic, and the dentist disconnected the mouth part of the apparatus and continued to administer gas through the nose for another two minutes, while he extracted three teeth. Then he discovered that something had gone wrong. An attempt was made to resusciate the patient, but he was dead.

The death certificate stated that the deceased had died of asphyxia by nitrous oxide gas during extraction of teeth. The physician who made out the certificate testified that nitrous oxide gas administered for three minutes, especially when it is continued after the patient becomes cyanotic and emits warning "gurgling sounds," would be a competent cause of the patient's death. Two dentists gave it as their opinion that the death was caused not by the gas but by heart failure.

The jury's verdict of $2,500 for the estate of the patient was sustained on appeal, inasmuch as the evidence justified such a finding.[22]

In the course of the extraction of a patient's tooth, nitrous oxide gas was administered by the dentist, and the patient died. The deceased had been in good health prior to the extraction. However, no specific cause or negligence on the part of the dentist could be alleged, except that the death could not have occurred but for the negligence and lack of proper professional care.

In an action of this kind, said the court in dismissing the complaint, there must either be alleged and proved a lack of requisite knowledge and skill, or there must be alleged and proved a failure to exercise a proper degree of care and diligence on the part of the dentist or some state of facts connected with an instrumentality in the control of the dentist which brings about a result so inconsistent with the normal and usual result that it must presuppose negligence. Alleging merely that death was caused while the patient was under the anesthetic, without proof of negligence, is insufficient.[23]

A patient suffering from an exophthalmic goiter consulted a surgeon who advised surgery. Patient and her hus-

21. Yaggle v. Allen, 24 App. Div. 594, 48 N.Y.S. 827.

22. Harris v. Wood, 214 Minn. 492.

23. Mitchell v. Atkins, 36 Del. 451, 178 A. 593.

band requested the surgeon to perform the necessary operation in a hospital. The operation progressed until about half of the goiter had been removed, when the patient died.

When the surgeon sued the husband for the value of his professional services, the husband introduced evidence that no blood test was taken prior to the operation and that such a test is usual to determine the oxygen-carrying power of the blood, which if below a given point renders an operation of this character extra hazardous.

The court held that the surgeon cannot be deprived of the reasonable value of his services because the patient died during the operation, unless there was evidence that death was the result of lack of skill on his part. There was no such evidence; showing that no blood test was made without proof that the omission was a contributing cause of death left the matter to speculation. Such evidence is insufficient to prove lack of skill.[24]

The preanesthesia study of the patient acts as a protection for the surgeon; in the event of a malpractice action against the surgeon or anesthetist, the record may be the best proof of whether or not a certain test or examination was made.

It was claimed by the widow that the patient had a cold at the time he went to the hospital and that he complained of pain and heavy breathing. As a result of a surgical operation the patient died; three physicians were sued by the widow for negligence. One of the doctors, a general practitioner, treated the deceased for a chronic inflammation of the gallbladder. An x-ray confirmed the diagnosis of "cholecystitis in pathological gallbladder." The patient was admitted to the hospital where this physician examined his heart and lungs and made a urinalysis. He found nothing wrong except the "gallbladder symptoms." He recommended a surgeon to remove the gallbladder.

The night before the operation, the surgeon examined the patient, had his temperature taken by a nurse, talked with him as to his symptoms and complaints, examined his chest with a stethoscope, and "dilated and percussed to determine whether his lungs were in normal condition, and his heart." He found no evidence of a cold.

The medical anesthetist said he took no steps to ascertain the condition of the patient's kidneys other than inquiring about it from the other two doctors. A nephritic condition would increase the risk of administering ether to a certain extent, but, he stated, an "organized" pleurisy means a healed condition which would not indicate itself in a proper preoperative examination. He added that about 20 minutes before the operation he asked the patient whether he had a cold recently, examined his lungs, heart, blood pressure, and pulse, and ascertained his temperature and that the urine examination had been made, that there was no indication that the patient had a cold or was suffering from pleurisy or a heart or lung condition, and that he was a good risk.

All three doctors participated in the operation. Ether was administered by the cone method; the patient remained anesthetized until the gallbladder was removed "and also a partial sewing up of the wound." Suddenly it came to the anesthetist's attention that the patient

24. Harvey v. Richardson, 91 Wash. 245, 157 P. 674.

stopped breathing. Attempts to resuscitate him failed.

Cause of death as certified to by the medical examiner was: "Syncope while under the influence of ether administered as a surgical anesthetic for cholecystectomy—accidental." He testified the autopsy showed the heart was better than average, that there were no gross defects, and that it was dilated owing to a terminal condition at the time of death. He had an organized pleurisy, arteriosclerotic nephritis, proliferative aortitis, and hypertrophic arthritis of the spine. The cause of death was the ether plus the surgical shock, and the important factors in the death were nephritis, the heart, the pleurisy, the ether, and the operation. He said the pleurisy might theoretically have been detected by the use of many x-rays, but not "practically"; the kidney condition could probably have been detected by prolonged examinations over a long period of time, but "it wasn't doing him any harm." The heart condition could not have been discovered before the operation. From a surgical viewpoint the operation was well done. The man's whole condition caused the death when ether was added to it. He made no reference to a cold.

In the face of medical testimony that there was no abnormal condition of the heart, lungs, or kidneys and no cold at the time of the operation and no findings by the medical examiner of unusual conditions which would make it improper to operate, the court was justified in dismissing the complaint. These were matters which could not be left to the common knowledge and experience of the jury, and there was no medical evidence of any negligence.[25]

25. Vartanian, Admx. v. Berman, 311 Mass. 249.

These cases illustrate some of the legal problems involved in the administration of anesthesia and serve to point out certain general rules which are applied by the courts.

In the administration of anesthetics, as in the case of other drugs, the physician must have the requisite degree of skill and care. If he uses anesthetics, he must know the properties of the drugs and understand their effects on the human body and take precautions for the patient's after-care. As part of his care he is required to make a preanesthesia examination of the patient to determine whether the particular drug is suited not only to the purpose of the operation but to the patient's physical condition.

"It would be criminal negligence for any doctor ever to administer ether without advising himself in advance, by an examination, as to the condition of the patient," said the court in an action by the administrator of a deceased patient.

While it is clearly the duty of the surgeon to make a preanesthesia examination in every case, the law does not specify exactly when or how extensive it shall be, except that the practice must conform with a reasonable standard among physicians in the light of the circumstances and the observations by the surgeon of his patient. Whether or not a second examination should have been made immediately preceding the administration of the anesthetic is also a matter of expert opinion.

It should not be taken for granted that consent for the use of anesthetic is a matter of course when the patient submits to surgery. The surgeon or the hospital should obtain a consent not only to operate but to the use of "any anesthetics."

Good medical practice requires the making of the necessary laboratory examinations before an anesthetic is administered. Proof that the failure to make a blood test was responsible for the patient's death will make the physician liable. However, there must be expert evidence to show causal connection between the absence of the test and the death of the patient.

In the event of a malpractice action against the surgeon or anesthetist, the record may be the best proof of whether or not a certain test or examination was made.

Unless it can be shown that the anesthesia apparatus was defective or that the anesthetist employed by the hospital was lacking in training and experience, the hospital would not be liable for the anesthesia death of a patient.

There is in hospitals a triple responsibility, the surgeon being responsible for the professional care of the patient, the anesthetist being responsible for the anesthetic she is giving under his orders, and the surgical supervisor being responsible that the strict surgical technic is observed, that regulations are obeyed by all, and that the schedule of operations proceeds as smoothly as possible. Therefore, it is essential that the nurse anesthetist give the surgical supervisor her complete co-operation while in surgery.[26]

In addition to what the courts have to say about the responsibility of the nurse who administers anesthesia, comments are made in various journals. One writer in the Journal of the American Medical Association for Apr. 6, 1946, poses the question as to whether it is right or wrong to hold nurses responsible as technicians in anesthesia. He thinks it is wrong to have doctors "serve as a figurehead in assuming responsibility for the acts of technicians which involve decisions of a medical nature, decisions in which they take no part." He also objects to the preparation of nurse anesthetists and states in part ". . . attempts to make anesthesiologists of people without a medical background will delay or prevent the future service which ought to be expected from anesthesiology. If we attempt to teach nurses the science and art of anesthesia, that is also wrong because it exploits the medical students who wish to learn anesthesiology while in school and may wish to practice it after graduation."

Such complaints undoubtedly are not unfamiliar to the nurse anesthesiologist; it is mentioned, however, merely to show that one cannot live in a fool's paradise. The courts, as you have seen, have something to say about anesthesia administration both by doctors and nurses; the legislatures, too, have an interest in the subject. Any profession which wishes to guard itself against legal infringements on its rights must be alert to what goes on, not merely in the hospital or in the nursing profession but in the legislatures and the courts. A very simple illustration of what it means for an organization to watch legislation is indicated by an article in Hospitals of October, 1945, on page 52 entitled "The Benefits of Being Informed." Counsel for the association is furnished with a daily service from the state capital of each bill when introduced. He selects those of interest to hospitals and advises the legislative committee of the significance of their provisions; a conference is held to de-

(Continued on page 42)

26. Hardgrove, A. E.: Organization and administration of a department of anesthesia. Hospitals **10**:119-121, June, 1936.

REPORT ON QUALIFYING EXAMINATIONS

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Cleveland

Three qualifying examinations for admission to membership in our association have now been held. The fourth is to be held on Nov. 11, 1946. Before we launch into the statistical results of our testing program, I should like to give you a brief résumé of the background of the association in relation to its testing program.

Prior to the inauguration of the examination program, the association had knowledge of the caliber of courses in anesthesiology for nurses only through the information returned on questionnaires mailed to schools, the information that the application blank of the individual applying for membership revealed, and later, around 1940, through personal visits to the schools by various members of the association.

The subject of approving the courses or schools has been under discussion since the early days of the association. The member visitation to schools was the first step in this program. The war intervened, and the acute nurse anesthetist shortage developed; schools sprang up here and there all over the country. For obvious reasons the inauguration of an approval program for schools or courses was not feasible. But the graduates of these newly organized courses, as well as of older courses about which there was doubt as to the quality of the training, were applying for admission to membership.

It was the decision of the board of trustees to put an examination program into operation at the earliest time possible for the best interests of the association and as the fairest way to handle the situation from the standpoint of courses about which the association knew very little, as well as from the standpoint of the individuals who were applying for membership after taking such courses.

Late in 1941 your present chairman accepted the chairmanship of a special committee to study plans for a program of examinations. This study occupied a period from 1942 to January, 1944. The present plan for examinations was accepted by the membership in 1944. The work of the members of the special committee and the later appointed members of the Committee on Examinations included a revision of the application blank in co-operative effort with the then Membership Committee and the members of the board of trustees. It included the creation of a transcript form for each applicant which is now sent to the schools. It necessitated a rather extensive revision of the by-laws, which was carried out in co-operation with the Committee on Revisions. It included working out the entire mechanics of the program and, lastly, the examination itself.

Read at the Schools of Anesthesiology Assembly, Philadelphia, Sept. 28, 1946.
*Chairman, Committee on Examinations.

On the advice of persons in the field of education the objective type test was decided upon for our use. The claims for the new type examination as compared with the essay type are as follows:

1. It is more reliable.
2. It is more valid.
3. It is more objective.
4. It is more comprehensive. A much wider sampling of knowledge can be accomplished in a given length of time.
5. It is less dependent on physical endurance, ability to write rapidly, and ability in English composition.
6. It gives a wider distribution of marks and makes possible detection of differences in degree of knowledge which the essay type would not reveal.
7. It may be used to test skills as well as knowledge, organization of facts, application, and problem solving as well as recall.
8. It is more economical of time in scoring.
9. Because of its more comprehensive character, it is more effectual than the essay type for diagnosing strength and weaknesses.
10. It makes possible the comparison of classes or reactions of classes and scientific experimentation with methods of teaching and the content of courses. In our specific situation this would mean comparison between schools.
11. It frees the teacher from the suspicion of partiality in giving marks. It makes the scoring much more objective.

The Committee on Examinations has endeavored consistently to build these examinations according to the rules of good test construction. During the year of preparation for the first examination the schools on the list of the American Association of Nurse Anesthetists were asked to submit lists of questions and answers and, in any case where the subject matter is as yet of controversial nature scientifically, their authority for the answer given. The schools were very responsive, but with the exception of two schools the testing material submitted was in the form of essay type questions.

The year of preparation for the first examination included also the preparation of an outline of subjects for study by the qualifying applicant. There again this was an independent study by the Committee on Examinations, as the latest revised curriculum outline was issued around 1935 or 1936. The outline was arbitrarily divided up into five subject divisions. These as originally set up were:

Part I—Anatomy and physiology
Part II—Anesthetic agents and medications
Part III—Clinical aspects
Part IV—Gas therapy
Part V—Miscellany, which includes history, ethics, terminology, organization and management of an anesthesia and gas therapy department, and explosion hazards and safeguards.

The experience gained from the first three examinations has shown that part III, or clinical aspects, does not appear to be so difficult for the majority of the examinees as do the other four parts. According to the concepts of good testing methods, testing material should lead from the less to the more difficult. For the fourth examination we have therefore placed former part III as part I (to be given first), and former part I as part III.

The reason for the division of the subject matter as it was set up was to place related material together, in so far as it was possible, and to facilitate the work of the committee in preparing the examinations and in scoring them. The five parts, however, have been considered as one comprehensive examination. No weight has been given to any division of the subject matter. No ruling has been made that an examinee must pass any one or several particular

divisions of the examination in order to pass the examination. The passing or failure of a candidate has been based on the average taken on the five scores of the five divisions of the examination.

The new curriculum outline is about ready for issuance to the schools, and, following study of this new curriculum outline in relation to the examination outline, a reorganization of the material may be indicated. I believe, however, that the original and present outline for study covers the material as set forth in the new curriculum outline.

The Committee on Examinations asked for assistance from the field of education, and early in 1946 Dr. Adam Gilliland, professor of psychology at Northwestern University, was appointed by the board of trustees as our consultant. We are fortunate that Dr. Gilliland was able to be present at this assembly.

It seems that a question or two has been raised as to why we need outside assistance in the construction of our examinations. I believe it is an accepted fact that no test is a perfect instrument. But tests that are made out by someone who is an expert in the field of tests and measurements, or in the preparation of which such expert assistance has been available, are bound to be better tests than are tests that are constructed solely by a group such as ours, without advice and suggestions from an expert in testing.

The physical therapy group has sought help from the field of education in their testing program. The National League of Nursing Education sought help from the Co-operative Test Service of the American Council on Education and employs certain members whose full time task consists of constructing test items. If we are to make progress and use our testing program as an efficient instrument for evaluating the comprehensiveness and quality of the teaching program in the schools, as well as for evaluating the qualifications of the individual for membership in the association, we need assistance and we shall continue to need it, at least for the immediate future. We need it because the work for which we are trained has not fitted us for this task if it is to be done with optimal efficiency.

As the educational program of the organization expands, other committees will undoubtedly come to feel that outside assistance from the field to which their committee project is related will be of definite advantage in carrying their project through to successful completion.

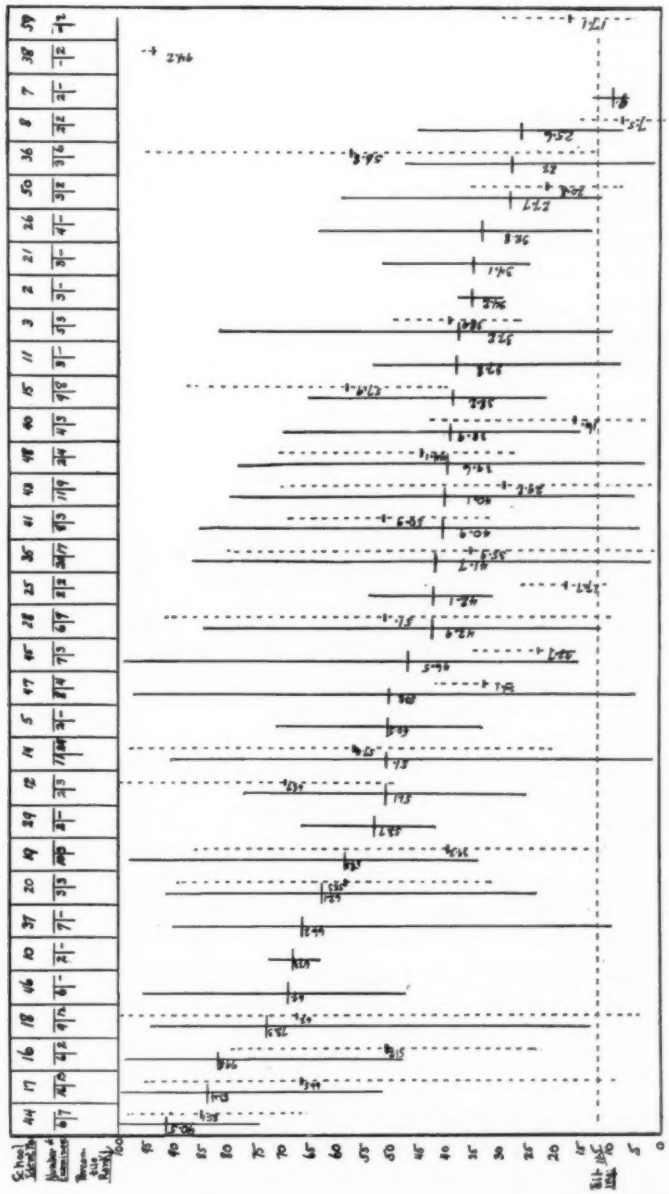
If I may digress from the immediate subject of this report for a moment, I should like to discuss another factor that I believe should be considered in relation to giving our national committees such assistance. The field of activity is rapidly broadening for the nurse anesthetist in the schools. She should be an expert clinical anesthetist and the clinical aspects of anesthesia have been making rapid strides. She must have a body of basic knowledge in all the sciences related to clinical anesthesia—anatomy, physiology (normal and abnormal), pharmacology, chemistry (inorganic and organic), physics—and, added to this, must acquire an ever increasing fund of knowledge as new facts and discoveries are being added rapidly from the field of medical research. But this is only a part of what the nurse anesthetist in the school should be and know. She should have a knowledge of psychology, normal and abnormal and educational.

She should have knowledge not only of the subjects she teaches, but she must know how to impart this knowledge to the students in the class room, the laboratory, and the operating room and how to give a fairly accurate picture of the results of her instruction in the tests she constructs and gives. She needs to know how to build or assist in building a curriculum, how to make out rating scales, how to make out lesson plans and study guides for students and written department procedures, how to organize and manage an anesthesia department and a gas therapy department, and how to keep the statistics for the department of anesthesia and gas therapy. For optimal efficiency I presume that each one of these functions would require the taking of a special course by the anesthetist. For education in some of these functions, courses are already available to her. These are courses in tests and measurements, principles and methods of teaching, curriculum construction, and methods of research. Further development of some of these functions will need to await the inauguration of courses specifically designed for the nurse anesthetist in one or more universities. And I hope that such a time may not be far distant.

Since the beginning of the organization the anesthetists in the schools have given generously of their time and efforts to organization activities, as have anesthetists from outside the schools. Our organization was built on volunteer effort. In some instances these members have used time for organization work that they desired and needed for personal and school improvement. They should continue to take an active part in organizational activities, but they must have time for both personal improvement and participation in plans for greater efficiency in the program of the school with which they are connected.

Expenditures to procure expert assistance which would lessen the amount of time spent by the members in association work and in carrying out successfully assignments that otherwise would produce limited and unsatisfactory results would seem to be justifiable. Any policy adopted that will not discourage the members from accepting important committee appointments and will not prevent them from continuing self-improvement will thereby consistently help to raise the standards of the schools and the group. This I believe would constitute a sound policy in relation to long range planning of the association.

To return to the subject of the qualifying examinations, our standing rules state that we will not divulge the grades of the examinees. The schools have been asking for the grades made by their graduates in order to learn how their school is measuring up to the standards of other schools. In order that we may use the results of the testing program for purposes other than evaluating the individual for membership in the association, it is necessary that we compile statistics for publication. It was considered wise to await the results of several tests before statistics were published. We have now prepared these statistics for you on the percentile rank of your graduates. This is not the grade made by the examinee but the position of the score made in relation to all other scores made. We have prepared percentile rank sheets for the second and third examinations for each school or hospital in which a course has been conducted.



The first row of figures at the top of the columns shows the school identification number for the third examination. The solid vertical lines show the spread of percentile rank on the third examination, and the number directly above each vertical solid line is the number of examinees. The dotted vertical lines and the number directly above each dotted vertical line is the number of examinees. The short solid horizontal lines show the mean, or average, percentile rank on the third and second examinations respectively. The dotted horizontal line across the lower portion of the graph indicates the lowest passing percentile rank.

I have outlined in graph form the results of the second and third examinations. This graph shows the spread of percentile rank for each school from which two or more graduates took the qualifying examination. This graph is worked out on the averages only. The horizontal lines on the graph show the mean of the percentile rank for each school (see Figure).

Since the examination program has preceded an approval program for courses in anesthesiology, there are a number of factors that should be considered in relation to the results of these examinations. These are:

1. Student selection and student performance for graduation
2. School curriculum
3. Faculty qualifications
4. Effectiveness of teaching

At present these are not only uncontrolled factors but largely unknown factors as far as the association is concerned. As yet we have not developed aptitude tests. Relative to such tests, however, I do not believe we have ever decided on paper what a nurse anesthetist should be and know and how and what she should be able to do.

We have not used general information tests or pretests on nursing subjects to guide us in our selection of students. We have not as yet put a school approval program into effect that would specify and establish minimal standards in schools if their graduates are to merit acceptance for the qualifying examination.

It is therefore obvious that we are using the same yardstick of measurement in the qualifying examination in gaging the knowledge and ability of individuals who may vary rather widely in native intelligence and in their total background of education and training.

It is likewise obvious that before we can remedy some of the weaknesses in the testing program, the gaps in our educational program must be bridged.

ANESTHESIA IN CARDIAC SURGERY

(Continued from page 18)

per se; one patient died on the twentieth postoperative day probably of anoxemia, and at autopsy he was found to have a two-chambered heart. Another child died 11 hours after operation, and at autopsy the anastomosis was found to be thrombosed. The last patient died under rather unfortunate circumstances. It was discovered that she had apparently been too heavily and continuously sedated. At necropsy a large mucus plug was found in the right main bronchus.

It is most difficult to assess the responsibility of the anesthetist in these deaths. In some of them he undoubtedly played a major role. But in each case there were other factors that might as reasonably be held responsible for the death. We do not wish to minimize our errors in this regard, but we do wish to point out that the physical condition of these patients and the nature of the operation and its effects have probably been of greater influence than the anesthesia factors.

By and large anesthesia in cardiac surgery is no different from anesthesia in any other intrathoracic procedure. In the last analysis, however, the success or failure of a venture in anesthesia does not depend so much on the agent or technic employed as on the skill and knowledge of the anesthetist. In closing I should like to acknowledge the rare privilege it has been to be associated with Drs. Lamont, Blalock, and Taussig and their colleagues.

CALENDAR OF COMING EVENTS

February 12-13	Mid-South Postgraduate Nurse Anesthetists Assembly, Hotel Peabody, Memphis, Tenn.
March 24-25	New England Assembly of Nurse Anesthetists, Statler Hotel, Boston
March 27-29	Annual Meeting, Texas Association of Nurse Anesthetists, Houston
April 23-24	Annual Meeting, Pennsylvania Association of Nurse Anesthetists, William Penn Hotel, Pittsburgh
May 5-7	Tri-State Nurse Anesthetists Assembly, Chicago
May 26-30	Institute for Nurse Anesthetists, Hotel Jung, New Orleans
September 22-25	ANNUAL CONVENTION, AMERICAN ASSOCIATION OF NURSE ANESTHETISTS, St. Louis

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CHALLENGE TO ANESTHETIST

(Continued from page 21)

our medical schools to teach the medical student who later becomes the operating surgeon and takes full responsibility for the patient.

In conclusion may we point out that if your profession, the nurse anesthetist, will continue to give good service of high quality at reasonable cost to the patients and if your schools of anesthesia increase and maintain in number and continue to raise their standards, you will have gone a long way in meeting the challenge. We should like to point out, however, two other considerations. One is that anesthesia requires in the modern hospital the combined efforts of three groups: the hospital where the anesthesia is given, the school of anesthesia—and this includes medical schools where the medical student who is the future surgeon receives his basic knowledge of anesthesia—, and the manufacturer whose business it is to produce the specific agent, be it drug or gas. On the other hand, in the modern hospitals there must be the greatest collaboration on the nurse anesthetist's part with the operating surgeon, the ability to understand and work within the range of the patient's psychology, and the ability to work with the intern and assistant resident and, above all, to co-operate with and attain the co-operation of the nursing service in the hospital. The nurse anesthetist needs the good will and assistance of the intern and nursing profession, and considerable effort should be made by you as individuals and by your organization to gain their good will and understanding. That will further help you meet both challenges which confront you today and in the future.

TESTING AND TESTS

(Continued from page 25)

something different from what is taught in the classroom. They measure the general worth of the candidate. They are used as a general over-all estimate of the person's ability.

A person might make a high score on the intelligence test but not make a good anesthetist because she does not know the fundamental steps of her job. But intelligence plus training should be indicative of success. These two factors together with a high professional attitude should constitute the qualifications essential for the success of your organization.

ANESTHESIA: LEGAL AND ILLEGAL

(Continued from page 34)

termine what position the hospitals are to take on the particular bill. This is presented in a series of bulletins which analyze the bills and comment on their significance, each being sent to every hospital administrator in the state. The administrator frequently takes up the contents with his board. A discussion takes place at the regular monthly meeting of the association, and a vote is usually taken as to what action to take. A brief is prepared by counsel, or a letter or memorandum with copies is sent to the standing committee of the legislature which has the bill under consideration. At times individual representatives of the association or counsel has personal interviews with influential members of the legislature. The article ends with the statement: "Thanks to our 'alerted' officers, trustees and administrators, we are equipped not only to repel assaults on our interests but to press for beneficial laws."

NOTES AND THE NEWS

At the INSTITUTE FOR NURSE ANESTHETISTS in New Orleans, May 26-30, 1947, an up-to-the-minute refresher course will feature lectures and demonstrations on physiology, pharmacology, and inhalation therapy. Dr. John Adriani and Dr. Alvan L. Barach are among the distinguished speakers to appear on the program. Only 120 nurse anesthetists will be admitted, and only those who are members of the A.A.N.A. or of the A.H.A. or are working in hospitals which are members of the A.H.A. are eligible. Nurse anesthetists attending all sessions will receive a certificate. The registration fee is $25. An application form and complete program may be obtained from the American Association of Nurse Anesthetists, 18 E. Division St., Chicago 10, Ill. This is an opportunity in postgraduate education for nurse anesthetists that is not to be missed.

The TRI-STATE NURSE ANESTHETISTS ASSEMBLY will hold its yearly conference in conjunction with the Tri-State Hospital Assembly at the Palmer House in Chicago, May 5-7, 1947. Among the outstanding speakers on the program are Dr. Frederic Schreiber of Detroit and Dr. John Keeley of Chicago.

An invitation is also extended to all nurse anesthetists and hospital administrators to attend the second annual meeting of the NEW ENGLAND ASSEMBLY OF NURSE ANESTHETISTS at the Statler Hotel in Boston, May 24-25, 1947. Use and management of the therapeutic drugs, helium, oxygen, and carbon dioxide, will be featured at the New England Hospital Assembly. Further information may be obtained from Esther Myers Stephenson, 7 Wolcott Rd., Winchester, Mass.

The date set for the next QUALIFYING EXAMINATION is May 19, 1947. In order that state registration of the candidates may be verified, transcripts and references obtained, and applications submitted to the Committee on Credentials, the applications must reach the executive office by March 1. The hospitals at which the examinations will be conducted depend on the geographic location of the examinees and will be announced later. The 239 examinees who took the qualifying examination on November 11 will be notified of the results on or about March 1.

The EDUCATIONAL EXHIBITS COMMITTEE was created to give help and information on the planning of exhibits for state assemblies and association meetings. In order that the exhibits may conform with the program and policies of the national association, the chairman, Marie N. Bader, 2300 N. Cascade Ave., Colorado Springs, Colo., should be notified of any proposed exhibit.

Dues are payable on or before March 1. Members belonging to state associations pay dues to their state treasurer. Those living in states having no state association of nurse anesthetists send their dues to the national executive office in Chicago. All checks should be made payable to the American Association of Nurse Anesthetists. Members failing to pay dues by March 1 are removed from the mailing list but may be reinstated if full dues and the penalty fee of $3 are paid before September 1. Members who fail to pay dues by that time must reapply for membership and take the qualifying examination.

In the committees for 1947, the Executive Committee has been eliminated. In its place, a Planning Committee has been set up. This committee is to act in an advisory capacity to the board of trustees. In addition, it will study and prepare recommendations for committee appointments and make long range plans for the future of the organization.

STANDING COMMITTEES

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Mabel Courtney
Miriam Shupp
Marion Wark Thomas

Approval Committee
Gertrude Fife, Chairman
Verna Bean
Hazel Blanchard
Sr. Seraphia
Esther Myers Stephenson

Approval of Minutes
Opal Schram, Chairman
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Sr. M. Lillian

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Myra Van Arsdale

ARKANSAS. The annual meeting of the Arkansas Association of Nurse Anesthetists was held at the Albert Pike Hotel, Little Rock, on Oct. 31, 1946. The meeting was called to order by the president, Mrs. Lamar McMillin. Minutes of the previous meeting were read and accepted. The treasurer's report showed a balance of $316.89. Officers elected: president, Dessie Merle Cox, 1717 Gaines St., Little Rock; vice president, Jewell Wells, 1100 Cherry St., Pine Bluff; secretary-treasurer, Ruth Eldred, Sparks Memorial Hospital, Fort Smith.

CALIFORNIA. A meeting of the California Association of Nurse Anesthetists was held at Permanente Hospital, Oakland, on Aug. 19, 1946. The president, Edna M. Peterson, presided. Thirty-six members and one guest were present. Minutes of the annual convention held in Los Angeles in May were read and approved.

Revision of the by-laws to permit voting by mail was discussed, motion to this effect having been made and carried at the convention in Los Angeles. Since this change would entail considerable time and expense, it was voted to present the matter at the annual convention in Philadelphia. It was also decided to present at the annual convention proposals concerning a Western States Assembly, comprised of Oregon, Washington, and California.

Martha Bichel gave a complete report on all that had transpired between the San Francisco Employers' Council and the California Association of Nurse Anesthetists Salary Adjustment Committee since Nov. 28, 1945. It was voted that the Committee on Salary Adjustment and Personnel Practices be given full authority to act for the California Association of Nurse Anesthetists. The president was authorized to appoint three members to serve as a Personnel Practices Committee.

The president and secretary-treasurer were appointed delegates to the annual convention of the American Association of Nurse Anesthetists in Philadelphia, with all expenses paid. After the business meeting the drawing for savings bonds was held. The secretary-treasurer reported that the sale of bonds had netted the association $600.

Edith Jones invited the association to hold the November meeting at the St. Francis Hospital in San Francisco.

COLORADO. A meeting of the Colorado Association of Nurse Anesthetists was held Dec. 2, 1946. Officers elected: president, Leila I. Mullen, 1153 Colorado Blvd., Denver; vice president, Margaret Kramer, 20th and Wadsworth Blvd., R. F. D. 172, Denver; 2d vice president, Lucile Sullivan, 1630 Fillmore St., Denver; secretary-treasurer, Julia Kassanchuk, 4200 E. 9th Ave., Denver; trustees: Mrs. Louise Allen (1949), Mrs. Henrietta Moon (1948), Mrs. Ann Stevens (1947).

ILLINOIS. The annual meeting of the Illinois Association of Nurse Anesthetists was held Sept. 15, 1946, at 1508 N. Larabee Street, Chicago.

After a luncheon, the meeting was called to order by the president, Mrs. Julia Baines. Annual reports were given by the treasurer, Exire O'Day, secretary, Mrs. Burlie Eggleston, editor of Isana, Mrs. Mary DuBusker, and the president, Mrs. Baines.

Two colored films were shown: "Dynamics of Respiration," under the direction of Dr. Ralph M. Waters, University of Wisconsin, and "Pediatric Anesthesia," by Dr. Digbee Lee, Ontario, Canada.

Officers elected: president, Mrs. Opal Schram, Wesley Memorial, Chicago (1948); 1st vice president, Mrs. Corinne Millen, Lutheran Deaconess Hospital, Chicago (1947); 2d vice president, Anna Ronn, Passavant Hospital, Chicago (1948); treasurer, Exire O'Day, Ravenswood Hospital, Chicago (1948); trustee, Mrs. Mary DuBusker (1948).

MARYLAND. The first meeting of the Maryland Association of Nurse Anesthetists since it became an affiliate member of the American Association of Nurse Anesthetists was held Dec. 2, 1946, at Johns Hopkins Hospital. Fifteen members and many of the hospital personnel attended. The meeting was called to order by the president, Mrs. Marion Wark Thomas. Minutes of the last meeting were read and approved. It was voted to revise the constitution to abolish the state committee on credentials. It was voted to apply for membership as an Associate Institutional Member of the Maryland-District of Columbia Hospital Association and of the American Hospital Association. The applications were subsequently accepted by both associations. Mrs. Thomas suggested forming an assembly to include Maryland, Delaware, and Washington, D. C. An informal discussion on curare by Lew Wright, M.D., of Squibb's Laboratory preceded the showing of films on "Curare" and "Anesthesia for Pediatric Surgery."

In a previous listing of trustees, the name of Ruth S. Elliott was omitted and should replace that of Laura Sullivan

MICHIGAN. The ninth anniversary meeting of the Michigan Association of Nurse Anesthetists was held Nov. 9, 1946, at St. Mary's Hospital, Detroit. The meeting was called to order by Mrs. Meyers, president. The secretary read the minutes of the last meeting.

After a short business meeting, Mrs. Kathleen Dedenbach, program chairman, presented the following program:

"Choice of Anesthesia in the Seriously Ill"
Dr. Alexander Blaine
Alexander Blaine Hospital, Detroit

"Report of Schools of Anesthesiology"
Esther Meil, M.A.A.N.A.
Henry Ford Hospital, Detroit

"First Hundred Years of Ether Anesthesia"
Dorothy Kinlock, M.A.A.N.A.
Receiving Hospital, Detroit

"Main Accidents Which Occur during Anesthesia"
Mary Louise Aden, M.A.A.N.A.
Mt. Carmel Mercy Hospital, Detroit

MINNESOTA. The Minnesota Association of Nurse Anesthetists held its first fall meeting at Northwestern Hospital, Minneapolis, on Sept. 24, 1946. A program followed the business meeting. A film on "Vagotomy" as done by Dr. Nordland at the Northwestern Hospital, Minneapolis, was shown. Mrs. Martha Lundgaard of the General Hospital, Minneapolis, gave a lecture on "Methods Used in Teaching Technic of Administering Cyclopropane." Twenty-three members and two visitors were present at the meeting.

The October meeting was held at Eitel Hospital, Minneapolis, Oct. 29. The business meeting was called to order by the president, Elaine Striemer. Minutes of the September meeting were read and approved. The treasurer reported a balance of $1016.83 in the treasury. Ruth Bergman, chairman of the Educational Committee, reported that she would contact the University about having a continuation course, or a series of lectures for anesthetists. Delegates to the national convention, Ruth Bergman and Florence McQuillen, gave brief reports of the meeting held in Philadelphia. Twenty-nine members and three visitors were present.

The November meeting was held Nov. 26 at the Bethesda Hospital, St. Paul. After the meeting was called to order, minutes of the October meeting were read and approved. The treasurer reported a balance of $757.73 in the treasury. The Educational Committee reported that Dr. William O'Brien of the University of Minnesota would arrange for a continuation course subject to the approval of Dr. Ralph T. Knight, director of anesthesia at the University of Minnesota. Twenty-four members and four visitors were present.

MISSISSIPPI. A meeting of the Mississippi Association of Nurse Anesthetists was held Oct. 18, 1946, at the Edgewater Gulf Hotel, Biloxi, in conjunction with the Mississippi Hospital Association.

The program included:

"The Importance of Trained Anesthetists in the Hospital"
Mrs. Elizabeth Wates, M.A.A.N.A.
Jackson

"Sodium Pentothal"
Film by Abbott Laboratories
Discussion: Mrs. H. Lyons, Biloxi

"The Nurse Anesthetist"
Dr. W. H. Parsons, chief surgeon
Vicksburg Hospital, Vicksburg

"Cyclopropane"
Dr. Sidney Katz
Charity Hospital, New Orleans

"Intocostrin"
Film by E. R. Squibb & Sons
Discussion: Evelyn Allen, Jackson

Officers elected: president, Evelyn Allen, 1020 N. State, Jackson; vice president, Emma Easterling, Vicksburg Hospital, Vicksburg; secretary, Mrs. Georgia Regan, Magnolia; treasurer, Mrs. Willie Bruce Maroon, 744 Evergreen, Jackson; trustee, Sr. M. Crucifix.

NEW JERSEY. Mrs. Ruth Morton Nash, one of the founders and charter members of the American Association of Nurse Anesthetists, retired Oct. 15, 1946. Mrs. Nash entered nurses training at the Titusville General Hospital, Titusville, Pa., in 1907 and took a course in anesthesia at the Post-Grad-

uate Hospital, New York City. Her first position as nurse anesthetist was at Long Island College Hospital, Brooklyn. She organized the school for nurse anesthetists in that hospital in 1918 and taught anesthesia to the medical students from 1925 to 1934, when she accepted a position at Muhlenberg Hospital, Plainfield, N. J., where she remained until her retirement.

OREGON. The annual Christmas party of the Oregon Association of Nurse Anesthetists was held Dec. 10, 1946, at the Graduate Home, Good Samaritan Hospital, Portland. President Elizabeth Johnson presided at the business meeting. A committee was appointed to formulate an agreement concerning working conditions of anesthetists in Oregon, to be presented to the Labor Relations Council of the Oregon Hospital Conference.

PENNSYLVANIA. The Pennsylvania Association of Nurse Anesthetists has voted to establish a Scholarship Loan Fund of $1,000, available to members of the state association for postgraduate work in anesthesia. A committee has been formed to study the administration of the fund. When rules and regulations have been established, announcement will be made in the JOURNAL.

TEXAS. The board of trustees of the Texas Association of Nurse Anesthetists met Nov. 9–10, 1946, in Temple. A report of the national convention was given by Winnifred Hackworth and Mrs. Jessie Compton. Plans were outlined for the annual state meeting which will be held March 27–29 in Houston.

UTAH. The Utah Association of Nurse Anesthetists is sending a gift subscription to the JOURNAL to a nurse at Northwest Nursing School, Lanchow, Kansu Province, China. [Good international relations.]

VIRGINIA. Cora E. Massie, anesthetist of the Grace Hospital, Richmond, died Dec. 9, 1946. Her loss is felt keenly by the Virginia Association of Nurse Anesthetists of which she has been an active member.

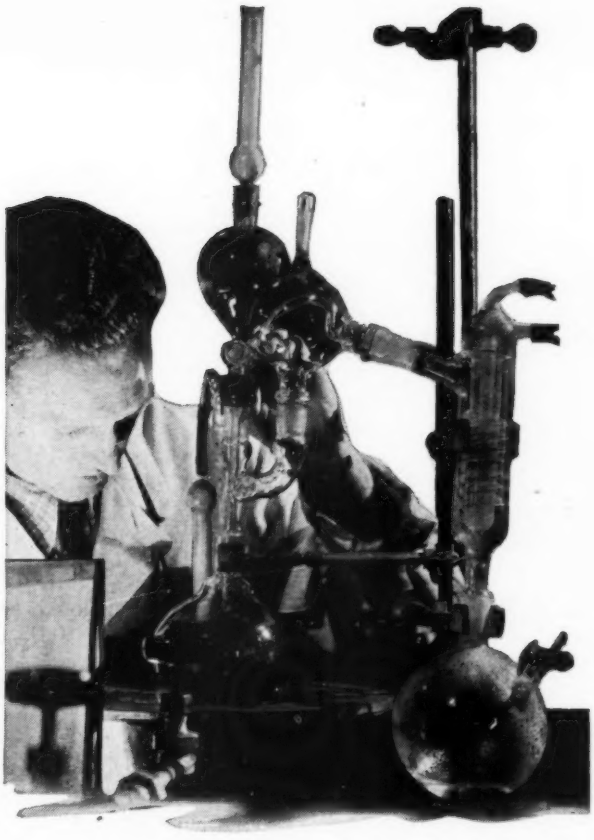
WISCONSIN. A regular meeting of the Wisconsin Association of Nurse Anesthetists was held Nov. 9, 1946, at Bellin Memorial Hospital, Green Bay. Esther Edwards, the president, presided. The minutes of the last meeting were read and approved. The report of Leone Theilen was accepted as read. Reports of the Membership and Program Committees were approved. It was voted to hold the annual meeting in November and a regular meeting in May; present officers will hold office until November, 1947. Esther Edwards, chairman of projects for the Tri-State Nurse Anesthetists Assembly, reported on the proposed projects for the May meeting. The Wisconsin Association is responsible for "History"; Mrs. Leone Higgins is the chairman of this project. Sr. M. Yvonne gave a report on the national meeting held in October. The secretary was authorized to ask the executive office if male anesthetists might become members of the association.

At the afternoon session the following program was presented:

"Cyclopropane Anesthesia"
Dr. Wilson Phillips
Mt. Sinai Hospital, Milwaukee

"Oxygen Therapy"
R. P. Packard
Puritan Compressed Gas Corporation

(Continued on page 52)



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ABSTRACTS

Christensen, E. M., Urry, A. G., and Cullen, S. C.: Alveolar and arterial oxygen contents during oropharyngeal oxygen therapy. Anesthesiology **7**:399-404, July, 1946.

"In 1931, Wineland and Waters reported a technic for the oropharyngeal insufflation of oxygen. . . . The oxygen concentration at the glottis during expiration was about 35 per cent with 3 liters of oxygen flow per minute and 50 per cent plus with 7 liters of oxygen flow per minute. The oxygen concentration was 74 per cent with 10 liters of oxygen flow per minute when the sample was taken during inspiration. . . . The work to be reported has been done to provide additional check on the efficiency of the oropharyngeal method of oxygen therapy. The oxygen content of the alveoli in 21 human beings and the oxygen content of arterial blood in 9 of these subjects were determined. . . . Samples of alveolar air and arterial blood were taken from volunteer patients and hospital personnel. . . . Alveolar air was obtained in the following manner: The subject held in his mouth a T-shaped mouth piece which was attached to one end of a 3 foot length of rubber tubing ½ inch in diameter. An air-tight glass syringe with a three way metal connector was fitted to the long end of the T. Air from both syringe and three way connector had previously been evacuated with mercury. At the end of normal expiration, the subject exhaled with force through the tube and the air sample was collected in the syringe. A number 14 French latex oxygen therapy catheter was then inserted through one nostril and into the oropharynx for a distance equal to that from the tragus of the ear to the side of the nose, and a flow of oxygen started. In most patients, swallowing of oxygen occurred and the catheter had to be withdrawn slightly. An alveolar sample was again taken after one-half hour of oxygen therapy. The oxygen supply was interrupted at the height of inspiration and the alveolar sample was taken in the manner described above. . . . Within a few minutes of the time the alveolar samples were taken, the arterial samples were drawn. . . . The data obtained from these procedures indicate that with a flow rate of 3 liters of oxygen per minute, the volume per cent of oxygen in the alveolar air rose from 14.14 to 28.39. With 7 liters of oxygen per minute, a rise from 14.78 to 40.62 volumes per cent was obtained; and with 10 liters of oxygen flow per minute, an increase from 14.67 to 50.11 volumes per cent was present. Simultaneous arterial samples were taken on 9 cases. . . . The arterial oxygen saturation increased from 91.8 to 94.8 with 3 liters of oxygen flow per minute, from 89.5 to 99.0 per cent on 7 liters of oxygen flow per minute, and from 92.8 to 102.5 per cent with a flow rate of 10 liters per minute."—Opal M. Schram, M.A.A.-N.A.

Belinkoff, S.: Choice of anesthesia in cardiac disease. Anesthesiology **7**:268-275, May, 1946.

For patients with a history of occlusion or infarction or subjective symptoms referable to anginal, precordial, or substernal pain, inhalation anesthesia is

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the method of choice, given by means of carbon dioxide absorption. These patients, who are usually in the older age group, are often apprehensive, and the first concern of the anesthetist is to allay this fear. In most instances, spinal anesthesia is contraindicated because of its tendency to lower both the systolic and the diastolic blood pressure. Cyclopropane, ether and oxygen have proved the most satisfactory. Nitrous oxide and ethylene do not provide sufficient oxygenation when given in concentrations high enough to produce surgical anesthesia. This type of patient is usually ideally suited to the use of balanced anesthesia, some form of local or regional anesthesia being combined with the general anesthetic agent. By this method the amount of the general anesthetic agent is decreased. Special care, however, must be taken to insure the preparation of a solution without adrenalin, since it is usually included when procaine is prepared for local anesthesia. The presence of adrenalin may precipitate a coronary occlusion.

The predominate symptoms of patients with decompensation are dyspnea on exertion, orthopnea, and ankle edema. Basal rales are often found on examination. The patient with a history of rheumatic fever and having a valvular lesion is also automatically included. Spinal anesthesia is the choice in this group. Spinal anesthesia causes dilatation of peripheral vessels and muscle relaxation in the caudad portion of the body and traps some blood there, thus reducing the circulating blood volume and the load on the heart. The reduced return to the right side of the heart helps correct the imbalance between the right and the left side of the heart and aids in the return of the fluid in the lungs to the general circulation, thus relieving the pulmonary congestion. The anesthesia thus acts as a bloodless phlebotomy. This theory is sound and is applicable to clinical anesthesia.

Patients with hypertension may be divided into two groups: those with elevation of only the systolic pressure and those with elevation of both the systolic and the diastolic pressure. The diastolic elevation is the more significant since it is upon the diastolic pressure that the coronary arteries depend for their blood supply. Inhalation anesthesia is the method of choice for all major procedures, with cyclopropane-oxygen (ether, in small quantities, if required to counteract arrhythmias) as the most desirable agent. This produces less systemic change than any of the other inhalation agents which are capable of producing muscle relaxation sufficient for intra-abdominal surgery.—Catherine Gallagher, M.A.A.N.A.

NOTES AND THE NEWS

(Continued from page 48)

"Pentothal Sodium Anesthesia"
Film by Abbott Laboratories
Richard H. Leukart

A dinner meeting was held in the Pompeian Room, Northland Hotel. Esther Edwards introduced the toastmaster, Dr. Wendell Killins, Green Bay. The program included:

"Curare in Pediatric Surgery"
Film by E. R. Squibb & Sons
P. E. Perkins

"Caudal Anesthesia in Obstetrics"
Dr. John Boersma
De Pere

"Progress in Medicine"
Dr. Merritt Jones
Memorial Hospital, Wausau

BOOK REVIEWS

Victory Over Pain: A History of Anesthesia. By Victor Robinson, M.D. 338 pages, 53 illustrations. New York: Henry Schuman, Inc., 1946. $3.50.

Victory Over Pain is one of the series of books in the Life of Science Library. Its appearance in October, 1946, marks the one hundredth anniversary of the first public demonstration of the administration of anesthetics for surgery. The story of the development of anesthesia, before and after that demonstration, is one which will interest many persons who are not engaged in the practice of anesthesia. Dr. Robinson has written this book in a style that will appeal to those interested in peoples and events. In the introduction the author states: "The revelation of anesthesia is a chapter in the life of science where it merges with the history of humanity: as such it should be a part of the general education of the present generation." His presentation of the subject makes this goal one which can be achieved with pleasure by the reader.

The search for relief of pain is as old as history, and conjecture alone makes it seem logical that it is as old as mankind. The early search for pain relief seems slow and unavailing as it is outlined in the first chapters of this book, but as the subject is developed, the early searches were found to be deviations from the path onto which the "discoverers" eventually stumbled. The stories of the men who so nearly approached the great discovery, such men as Humphrey Davy and Henry Hill Hickman, are written here. The story of mesmerism and hypnotism is told. An account of the horrors of surgery before anesthesia paves the way for the chapters on the actual discovery. Then follow the stories of the men, Crawford Williamson Long, Horace Wells, Charles Thomas Jackson, and William Thomas Green Morton, and the controversy which resulted from the claims of each. The acceptance of the discoveries in Europe and contributions of scientists in European countries are recorded. The discovery of local anesthesia and accounts of the work of the men involved in its development are presented. The book includes a consideration of new technics which have been developed since the first discoveries and drugs and methods which have been evolved. Brief recognition is given to some of the men who have contributed to the progress of anesthesia. It is regrettable that the tremendous advances made in recent years are dealt with so briefly. Some of those advances may someday offer stories as interesting as the first experiences with anesthetic agents and methods. Curare, adopted child of anesthesia, is included in the last chapter. An epilogue holds forth the hope of the author for a future of anesthesia that will outshine the past. Sketches and halftone plates contribute to the text.

People in Quandaries: The Semantics of Personal Adjustment. By Wendell Johnson. 532 pages. New York and London: Harper and Brothers, 1946. $3.75.

To interest the reader in this book it should suffice to quote from the introduction: "We all have personal problems, of course. Our awareness of them

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* **TITLE OF PAPER:** A Clinical Study of Carbon Dioxide Absorption During Anesthesia

AUTHORS: Major Lloyd H. Mousel, Captains William A. Weiss and Luther A. Gilliom; Medical Corps, AUS

Reprinted from: Anesthesiology, Vol. 7, No. 4, pp 375-398, July, 1946

. . Carbon Dioxide Absorbent

normal operating conditions.* The following significant quotations are taken from a report of those studies:

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and the importance we attach to them depend on the amount of tension, misery, and confusion we have learned to tolerate. Generally speaking, if we examine carefully what we call our big problems we find that they are made up for the most part of little things which accumulate all but unnoticed until we find ourselves practically overwhelmed. The most effective way therefore, to apply what is in this book is to sharpen our awareness of the little things and apply it to them."

This book cannot be read casually. The reasoning behind the semantic approach to the solution of personal problems is developed carefully and with sufficient detail so that the reader need not have had a previous introduction to the study of semantics. The importance of the scientific attitude in our daily thinking is stressed before the actual application of semantic principles is presented. Each new chapter depends on those preceding it for clear understanding of the subject. Unlike many authors who pretend to offer a solution to the problems of daily living, Dr. Johnson does make specific applications of the semantic approach in the solution of actual problems.

Anesthesia in General Practice. By S. C. Cullen, M. D. 260 pages, 53 illustrations, cartoons and graphs. Chicago: The Year Book Publishers, Inc., 1946. $3.50.

In this small volume are presented the essentials for a practical understanding of the fundamentals of anesthesia in general practice. It is not designed to give the specific details for all of the technics in anesthesiology but is intended primarily for use by part time anesthetists and others who may require a knowledge of good anesthetic practice.

The chapter on preanesthetic medication gives much valuable information regarding the drugs commonly used in this manner and their application. The pharmacology, dose, methods of use as well as treatment of toxic effects of preanesthetic drugs are considered in adequate detail. The importance of a good airway, the effects of a poor airway, the means of maintaining the airway, and the uses of this knowledge other than in anesthesia are only some of the things that are considered in the chapter on the airway. These two chapters on premedication and on the airway take more than a fourth of all the pages in the text.

The inhalation anesthetic agents and the technics for their administration intentionally are considered briefly. Curare, as an adjunct to inhalation anesthesia, is included in the chapter on inhalation agents. Usable technics, without too great deviation from simple standards, for spinal and regional infiltration and topical analgesia are considered. The signs of anesthesia, the recognition and treatment of shock, the use of oxygen therapy, and preanesthetic and postanesthetic care are considered, and the explosion hazards of anesthesia are discussed. A list of anesthetic agents available for office use concludes the text.

Illustrations are well chosen to enhance the teaching value of each chapter. Tables and cartoons, sketches and graphs are used throughout and add to the usefulness of the book. The book is an excellent presentation of the subject. Not only the beginner but the experienced anesthetist will find much of worth in the subject matter.

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1. Brewster, H. H.: The Use of Ether in the Narcoanalysis of Patients with War Neuroses, New England J. Med., 235:357-9 (Sept. 12), 1946.

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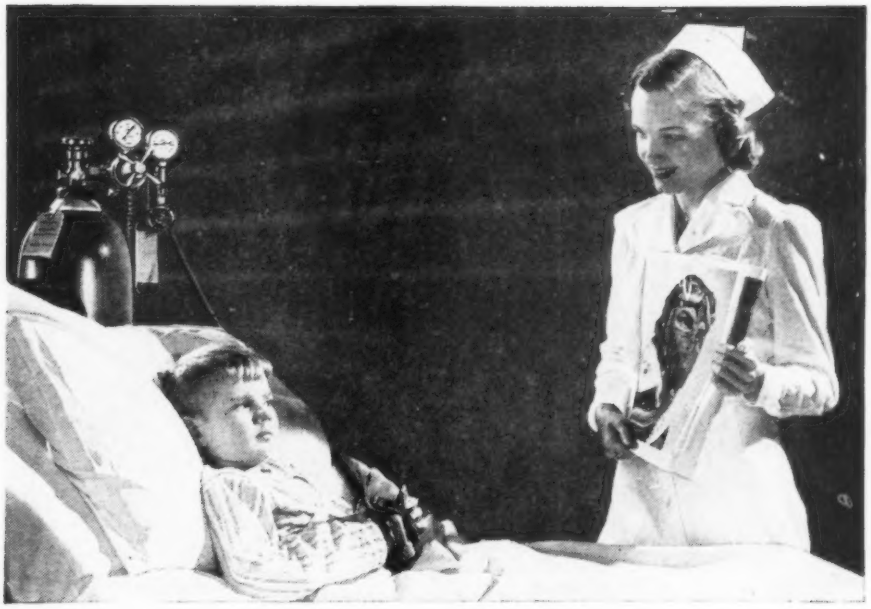

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